Forintek Canada Corp.

In co-operation with

Canadian Lumbermen's Association

and

Ontario Lumber Manufacturers' Association

presents

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Foreword

The following proceedings relate to a seminar entitled Improving Productivity Through Microelectronics presented at Timmins on November 21, 1983. The seminar was the second of four regional seminars, on the same theme, which were presented at various locations in eastern Canada. The preceeding seminar was held in Ottawa and two followed in Moncton and Quebec City. Financial support for the seminar was from the Federal Department of Regional Industrial Expansion.

Forintek Canada Corp. wishes to acknowledge the federal government contribution and the role of the Canadian Lumbermen's Association and the Ontario Lumber Manufacturers' Association as co-hosts of the seminar.

* * *

Opening Remarks

R.W. Stephens
Forintek Canada Corp., Ottawa

My name is Bob Stephens and I am Director of Research for Forintek's eastern laboratory in Ottawa and it is my privilege to be your chairman for today's proceedings. I would like to welcome you all here and certainly congratulate everyone for braving the freezing rain. I know that I sat on a plane in Toronto airport last night and did not think that I would reach Timmins.

As you may be able to tell from this inconspicuous sign behind me, we are here to talk about improving productivity through microelectronics and today's seminar is the third in a series of eight seminars which are being sponsored by the federal Department of Industry, Trade and Commerce and Regional Economic Expansion. These seminars are actually part of an exciting new federal initiative called The Industrial Regional Development Program, or IRDP, and you will be hearing more about that program from one of our speakers. As you probably know, if you have read the material sent to you for this meeting, Forintek is Canada's national wood products research institute and we have been retained by the federal government to organize and present these seminars in conjunction with industry associations. Our presence today is a result of the support and cooperation that we have received from the Canadian Lumbermen's Association and the Ontario Lumber Manufacturers Association. This linkage with the lumber associations is very important and I am very pleased to be able to report that so far, in our arrangement of these seminars, associations across the country have been extremely supportive. As you know, associations often provide this type of training and education for their members so it is quite natural for them to become involved with the Forintek program.

These seminars have three basic objectives and I think it is important to review them:

- They are designed to promote awareness of the links between technology and productivity.
- They are to provide practical information related to coping with technological change.
- They are to facilitate concensus building and information exchange between business and labor decision-makers.

These are very important objectives and needless to say I am not going to try and address them alone. The program this morning will address what we believe are some of the problems and opportunities ahead of us and this afternoon we will talk about the technical aspect.

At this stage, I would like to introduce my distinguished panel of speakers for this morning's session: Mr. Bob Renaud, Mr. Peter Murray, Mr. Rivard, and Mr. Mel Giles. We certainly appreciate the effort they have made to be with us today.

I would like to add a few words as I think everyone has a different expectation of what is going to happen. I have heard comments which indicate that some people are afraid that they are going to be blinded with science. Well, I assure you that this will not be the case. We are all groping our way slowly, but surely, towards technological improvement, hopefully at the same speed and with the same degree of commitment. The benefits of these seminars to industry are really dependent upon the individual company and its present level of technology. We have all heard that experiences in Canada with the application of microelectronics in sawmills have resulted in significant productivity improvements.

Another aspect of the microelectronic revolution that is attracting people's attention is that it may be an important factor in remaining competitive in world markets. More people are talking about world marketing these days, no doubt due to the rough ride we have had in the domestic market recently.

However, there is a great deal of pressure to be more efficient in countries where the resource is scarce. This is producing innovative technical developments and improved human skills. What I am saying in a polite way is that many parts of the world are way ahead of us in this type of technology. These countries are more efficient simply because they have to be. They do not have the forests that we think we have and basically admitted to the fact that they ran out of resources a long time ago. To compete against them, Canada, of course, must be just as efficient, just as aggressive and just as technologically advanced. As in all apsects of the free enterprise system, the market will simply decide who succeeds and who fails.

So today we gather to try and exchange what information we have to start setting the course towards improving productivity through microelectronics. We have speakers today who are knowledgeable about the technical details of the equipment and how it works. There are industry people here who will tell us of their own experience, inform us of the problems and pitfalls, and hopefully share with us some of their joys and triumphs. I am hoping that the discussions will cover specific equipment details, methods of application and operation, and also the impact of technology on the labor force which is a very important point that we must not overlook.

* * *

The Need to Update Canada's Wood Product Manufacturing Facilities

Part One

M. Giles
Grant Lumber Co. Ltd.

In presenting an industry overview, I will endeavor to give a brief flashback on sawmill development of yesterday and to touch on the technological developments in today's sawmill and to discuss, in general terms, the implications this technology has, and will have, on the woods economy, competition in the global market, research and development and industrial relations.

A Greek sage of many centuries ago stated that "change is the only thing that is permanent". If this philosophical law was true 2,500 years ago, it is particularly true today. It is an age of rapid change in which we live and strive. As Thomas Carlyle wrote: "Change, indeed, is painful but ever needful, and if memory has its force and worth, so also has hope."

When I compare the dimension of time of the Greek sage to the time frame of the past 25 years and the revolutionary changes in the woods industry and, in particular, in the sawmill, I surmise that our Greek philosopher would be stunned at the pace of this change.

If you were a manufacturer of jackpine and spruce lumber a few years ago, you could have built a portable sawmill for $25,000 to $40,000 for the sawing of 16-foot logs with a minimum diameter of six inches. When harvesting the logs, you left the tree tops on the forest floor and you recovered about 40 per cent of the log in lumber and the balance of slabs, trimmer ends, sawdust and bark went up in smoke in the teepee burner or into the camp or employees' wood stoves. It was a period where you reversed the earlier pattern and took the mill to the logs instead of logs to the mill. Again, the modern mill is permanently located in relation to the tree supply.

The sawmill was possibly driven by a diesel power unit and the equipment usually consisted of a carriage, circular saw or possibly twin saws, with a twin disc friction, a resaw, affectionately called the Katrine, a bull-edger and trimmer saws. With a kerf thickness of 5/16 of an inch, you could be assured of a high production of sawdust.

With the acceptance of pulpwood chips furnished for the nearby pulp and paper mills, ponds, debarkers and chippers were added to the sawmill. With the introduction of tree length harvesting by Bienvenue of Lasarre and the Dubreuil brothers of Dubreuilville, you saw the slasher as an adjunct to the sawmill. These technological advances increased the utilization of the tree to approximately 90 per cent in the form of lumber and waste. Waste is now respectfully referred to as 'the residue'.

But how things have changed! We have witnessed in the 70's the advent of the microelectronics age and the sophisticated sawmill. It has become the age of scanners, laser light lines, edger optimizers, electronic panels, microprocessors, computers, etc. and the modern mill now represents a multi-million dollar investment. It is interesting to note that fewer than 400 of these modern mills supply 90 per cent of the lumber produced in Canada.

The age of High-Tech (if I may use a popular 'buzzword') has engulfed the sawmill and other wood product facilities. May I suggest that it is here to stay.

This technical revolution has created and will continue to create a great socio-economic impact on our society and, in particular, on our industry. The recent Canada Tomorrow conference and I am certain that many of you followed its deliberations in which more than 750 scientists, businessmen and educators

participated, concluded that "Canada is destined for a very gloomy future unless Canadians stop being short-sighted and fearful of change." The majority opinion was that "Canadians must seize the new technologies and make them work to their advantage." "To do that", they said, "will require the revamping of many outdated institutions and value systems."

Technological progess is accelerating. Examples of this progress are:

- The recent announcement by IBM to enter the two billion dollar home computer sales with its PC Jr. As you are possibly aware. the expected life of a microcomputer is two to three years.

- The race between Japan and us to build a supercomputer that will nearly think and which is referred to as an 'artificial intelligence'; that is, it will understand information conveyed by sight, speech and motion.

In essence, what is in-date today, is out-of-date tomorrow.

Because of the ongoing development of microelectronics in the wood manufacturing industry, we will have to reassess our roles from time to time and to learn to compete with a new set of conditions.

Turning briefly to the Canadian economy, I think that we in the woods industry have to remind ourselves and the general public of our contribution to the economy. The interim report of the forest industries advisory committee points out that the forest industry:

- Employs some 300,000 Canadians and ships annually products worth more than $20 billion dollars.

- In terms of employment, wages and salaries, and value added by manufacture, is Canada's biggest manufacturer, and makes a larger net contribution to the nation's balance of payments than metals, food and agriculture, fisheries and the automobile industry combined.

- Canada accounts for more than one-fifth of the world's total exports of manufactured forest products.

- Canada today accounts for some 11 per cent of total world production of softwood lumber the largest component of the wood products sector.

For the province of Ontario alone, the value of shipments of forest products in 1981 were over $7 billion dollars.

The increasing world demand for woods products lumber, plywood, waferboard and other wood products is a projected increase of one per cent per year. In this world market, Canada must compete for the current and expanding markets with the Scandinavian countries, the U.S., the Soviet Union, and some third world countries. The determining factors in this international competition will be cost, quality and delivery of our products. And speaking of quality, if any of you have visited the sawmills in the Scandinavian countries, I am certain that you were impressed with the quality of the sawn lumber. Even the Soviet Union, which is not known for its efficiency, produces lumber of high quality.

To assist Canada in the international competition, there will be a need for an ongoing research and development program with emphasis on increased recovery, production and quality. To date, we Canadians have not been R&D oriented. Peter Newman in a recent article in Maclean's pointed out that Canada's expenditure on research and development was equal to Egypt's, a third world country. Quoting from A Forest Sector Strategy for Canada, 1981, "Canadians now spend less that 0.7 per cent of the forest products sales dollar on R&D, compared with 1.5 per cent in the U.S. We also lag behind our competitors in Scandinavia, Japan and New Zealand. It is generally accepted that expanded research is a necessary ccondition to expanding export sales."

In Canada, we have three research centres:

- Forintek, which conducts research on solid wood products and is funded 50 per cent by the federal government, 25 per cent by provincial governments and 25 per cent by industry.

- The Forest Engineering Research Institute of Canada, which conducts a program of logging research and is 50 per cent funded by the industry but is located in a building provided by the federal government. I may add the federal government is presently constructing a new facility in B.C.

When it comes to government participation in any field, I always cast a cynical glance. But in the field of R&D, I must compliment the federal and provincial governments of their leadership in this field. The Globe & Mail of October 12th, carried a news item to the effect that "the Quebec Government is going to put up $25 million dollars in credits over five years to help modernize the lumber industry in the province, in a program similar to that for the pulp and paper industry."

In an effort to encourage industry investment in R&D, the federal government is considering draft amendments to the Income Tax Act affecting R&D as a result of proposals in a white paper originated by Finance Minister Lalonde.

I would like to point out that a deterring factor for industry investment in R&D recently has been the absence of profitability during the past several years. I may add that the word 'profit', or business savings, is regaining its respectability. There is a simple economic fact and that is: If you don't make a buck, you don't stay in business.

So much for research and development.

As participants in a renewable resource industry, we must never lose sight of the 'human' resource our employees who will be greatly affected by the changes brought about by the microelectronics age.

Alan Jay Weiss in his booklet "The Revolution Around Us - Human Resource Development in the 80's" maintains that "there are some productivity gains to be achieved through advances in automation, robotics and computerization. But the most profound advances will come from the organization's human resources its people." Mr. Weiss goes on to state that, "As our economy increasingly swings to a service and knowledge basis, the productivity advance will be a result primarily of people and their relationship to work."

The intrusion of high-tech into the workplace is inevitable and this so-called new industrial revolution will bring about substantial changes in the occupational structures. Many workers will have to learn new skills and some will have to move to new jobs with different employers. It is even possible that the new jobs will be better than the old. Training and retraining will become a lifetime task. It is predicted that a young adult of today will go back to school three times during his working lifetime to sharpen his skills or learn a new skill.

Cliff Sandwell of C.T. Sandwell & Associates posed the question in an article in the August issue of Logging & Sawmilling Journal entitled "Will Managers Handle Tomorrows Mills?". Briefly, he stated that, "Managers at all levels will have to adjust to the new environment" and that, "The use of the computer in sawmill management, already being used in some mills, must become standard equipment in the next few years."

I suggest that we in the woods industry must go the route of microelectronics if we are to be competitive and to survive. There will be an element of pain because of lost jobs, but many more jobs would be lost if we turn our backs on technology. And here is the challenge: Can management, laour and government adopt a co-operative and constructive approach to the major adjustments in the workplace?

The roles of management and labor to-date have not been encouraging. They have been nurtured in the adversary system. A product of the Good Guy, Bad Guy syndrome. In 1982, Canada had the dubious distinction of having the highest number of days lost per 1,000 employees by strikes in the western world. We replaced Italy. I respectfully suggest that management and labor take a long hard look at the adversary system in industrial relations. It is a luxury we can no longer afford.

Ed Finn, Public Relations Director of The Canadian Brotherhood of Railway, Transport & General Workers, stated recently that, "After 21 years in the trenches of Canada's labor relations battleground, I'm convinced neither side can win. Even worse, if continued much longer it will do irreparable harm to all Canadians, not just the combatants." He goes on to say that, "Now we live in an era of much more complex economic realities. The problems posed by fierce international competition, multi-national corporations, microprocessors, dwindling resources and high inflation can be overcome only if we join together to tackle them. Co-operation and teamwork are the qualities most needed today." This is an opinion that is shared by Mr. Rowland Frazee, Chariman and CEO of The Royal Bank.

Personally, I am optimistic about the degree of co-operation of management, labor and government. And indication of this co-operation in the forest industry was the establishment of the forest industries advisory committee, co-chaired by Mr. Ian Barclay, a businessman, and Mr. James Buchanan, a union leader.

In conclusion, may I suggest that we of the woods industry will continue to live in challenging and changing times. A decision that we will have to make is whether we will swim or sink in what Alvin Toffler describes as The Third Wave the age of technology.

* * *

The Need to Update Canada's Wood Product Manufacturing Facilities

Part Two

A.T. Schuler
Forintek Canada Corp.

There have been recent concerns by government and industry that the Canadian wood products industry must increase productivity if it is to remain competitive in world markets. Maintaining competitiveness is extremely important for Canadian producers due to our heavy reliance on international trade. For example, Canada exports 70 per cent of its softwood lumber production accounting for approximately 45 per cent of all international trade in softwood lumber. In addition, Canada supplies approximately 27 per cent of the world's market pulp and 37 per cent of the newsprint used in the non-communist world. We also ship half of our waferboard to the United States.

We have investigated these concerns and have attempted to provide some insight on why productivity is now a major concern in a country, that historically has been the dominant force in a scarce resource. This report will emphasize solid wood products; however, due to the complimentary associations with the pulp and paper sector, the latter industry will receive some treatment.

Supply / Demand Considerations

Demand

Recent studies (1, 2) indicate that world demand for forest products will increase by two to three per cent per year in the next 20 years—three per cent in the pulp and paper sector and one per cent in solid wood products. Although this is considerably less than increases in the previous 20 years, it still represents a 50 per cent increase by the turn of the century.

Looking more closely at solid wood products, the softwood lumber demand picture is not as promising. World demand is expected to grow by a modest nine per cent by 1990 over 1979 levels—less than one per cent per year. Residential housing, the largest single user of softwood products, is expected to decline substantially during the 1990's, largely due to demographics in North America. Canadian housing starts are projected to decline to the 150,000/year level and U.S. starts will decline to an average level of 1.4 million/year during the early 1990's. However, most observers feel that these declines will be fully offset by increases in industrial uses (packaging, panelling, pallets, etc.) and the rapidly growing home renovation market in North America.

Looking more closely at the U.S. housing market, major declines will occur in the north east and north central states as Americans relocate in the south and southwestern regions in response to migratory trends and economic problems such as those facing the auto and steel industries. Canadian mills will face increasing competition from U.S. suppliers in servicing the southern growth area.

On the brighter side, Japanese imports of Canadian lumber are expected to increase from 1.1 billion BF to 1.8 billion by 1990; however, there will be increasing competition from the United States and other suppliers. European demand for Canadian lumber is expected to remain relatively stable in the next decade with the U.K. remaining the major market.

Regarding the softwood plywood industry, most projections show demand to increase in U.K., Western Europe, Scandinavia, and Japan. However, Canada will again face increasing competition in Europe and Japan from U.S. suppliers.

Physical Supply

Softwood sawlog supply is projected to increase by five per cent (non-communist world) by 1990 - less than one per cent per year. Major new sources will be Latin America, Oceania, Africa, the Middle East and S.E. Asia. Softwood lumber production will remain relatively stable in the next decade. Canada will increase production to 21 billion board feet by 1990,

an average annual increase of 1.4 per cent. U.S. lumber production is expected to return to 1979 levels (40 billion BF) and increase slightly by 1993. Lumber supply from Europe and Scandinavia will increase little, if at all.

There will be major increases in softwood lumber supply from New Zealand, Chile, and South Africa by late 1990's. These increases will occur as major plantation timber matures.

Economic Supply

Although physical supply is projected to match total demand (as it must), it is the delivered cost of timber that will have a major impact on allocating market share of the world demand. Canada has enjoyed historical economic advantage over international competition due to an abundance of natural timber. However, future world supply and demand will be more closely in balance and this means that suppliers with lower delivered wood costs will have a competitive advantage.

Canada's forest sector is entering a critical period of transition. The old growth stands are becoming less accessible and recovery costs are escalating. Similarly, existing natural stands have lower density and quality of timber, hence the value of timber harvested per land area is declining. Eventually, Canada will have to shift from an old growth timber-based economy to a managed second growth economy. However, this will take years because Canada has been very lax in her forest renewal program.

Canadian production costs are projected to increase at a two to three per cent annual real rate while costs are expected to remain relatively stable in Europe and to rise only slightly in the U.S. Higher harvesting costs, lower wood quality and diminishing supplies in Canada vis-a-vis the rest of the world are major contributing factors.

Canada will also face increasing competition at world market levels due to product substitution (composites for conventional lumber and panel products); intermediate and end-use product differentiation and shifts in the domestic forest policies of our major trading partners. The U.S.A., Scandinavia and Western Europe have relatively active forest renewal programs in place and, according to a recent report from the U.S. Office of Technology and Assessment, the U.S. may soon be in a position to be a major force in international wood product markets. Other factors include the proliferation of tariff and non-tariff barriers to trade.

Recent Productivity Trends

Cost competitiveness will be a prerequisite for economic survival in world wood product markets in the future. Canada will have to put relatively more emphasis on productivity in converting trees into wood products, simply because our production costs will be higher than most of our competitors and there will be tougher competition in all of our traditional markets around the world. We will have to find ways to compensate for higher relative wood costs, at least until our second growth forests are economically mature.

Labor Productivity

Recent labor productivity trends in Canada indicate that two sectors—saw and planing mills and veneer and plywood mills—are now more productive than the all manufacturing average (Fig. 1). This has been due largely to the introduction of labor saving technology in these industries.

Examples of ongoing developments are computer-controlled log handling and sorting systems; electronic scanners and computer system control of sawing, peeling, clipping, and drying operations; automation of finished lumber sorting and semi-automatic assembly lines in plywood.

These developments are, by the way, a complete reversal of the pre-1970 era when the forest products sector traditionally lagged behind the aggregate of non-agricultural industries in terms of productivity increases (3). For example, during the period 1961-69, labor productivity increased 3.9 per cent per year in manufacturing industries whereas only three per cent and 1.4 per cent increases were registered in the sawmilling and pulp and paper industries respectively.

A major difference between the U.S. and Canadian forest industry is that the American pulp and paper industry has made the most significant increases in labor productivity in the past decade (Fig. 2). In fact, the American pulp and paper industry is now the lowest cost producer in the world for major grades of market pulp. The veneer and plywood industry has also made significant gains, but there have been no such gains in the saw and planing mills.

Although labor productivity has been increasing in parts of the Canadian solid wood products industry, real unit labor costs have also been increasing (Fig. 3), particularly in the saw and planing mill sector. This means essentially that labor costs have been increasing faster than productivity increments. Conversely, unit labor costs in Canadian veneer and plywood mills have not increased as much in real terms over the past decade.

A look at similar developments in the U.S. indicates that unit labor costs for sawmills and planing mills have increased less than their Canadian counterparts

and unit costs in veneer and plywood mills have actually dropped by 20 per cent since 1965.

Comparing labor productivity on a world-wide basis, we see that Canada leads the world in physical labor productivity for the aggregate solid wood products industry (Fig. 4). We have twice the productivity of Norway and the U.S., and 1-1/2 times that of Sweden and Finland in terms of M^3/man-hour.

However, when we look at changes in productivity over time as measured by indices, we see that the Scandinavians are making great strides in improving productivity (Fig. 5), particularly during the period 1975-1980. Productivity increments in both Canada and the U.S. aggregate solid wood products industry have flattened out during the period 1977-1980.

Other Productivity Measures

Labor productivity is only one component of cost competitiveness. Capital productivity as measured by output per current value of capital assets is an integral component, yet it is very difficult to measure. Capital productivity represents a measure of the current level of conversion technology. Therefore, we can use conversion factors as a proxy for capital productivity. Conversion factors represent input of wood raw material required to produce a given level of finished wood product.

In the conversion efficiency category (Table 1), we see that Canada is the least efficient producer (world-wide) of hardwood lumber products. In addition, we are among the least efficient producers of softwood lumber and plywood products. The relatively high figure in the sawn softwoods column for the U.S. is misleading because production was based on actual dimensions whereas all others are based on nominal dimensions. The comparable U.S. figure is in the 1.85 - 1.95 range. Conversely, Canadian mills producing particleboard and fiberboard (waferboard) are the most efficient in the world.

These conversion figures are an indication that Canada is now having difficulty in converting smaller and lower quality raw materials into lumber and plywood products. In addition, many of our western mills are old and not geared to the available resources. On the other hand, the Canadian composite product facilities are relatively new and represent the latest technology available.

Future Concerns

Although physical labor productivity has been one of the bright spots for the Canadian forest products industry, there are other factors involved in determining cost competitiveness in world markets. Conversion efficiency, raw material costs and wage rates are all part of the picture. We have already discussed future problems with raw material costs, but there are other interesting developments that will impact on Canada's ability to compete in world markets.

We already mentioned that conversion efficiency leaves much to be desired in the softwood and hardwood lumber sector and in the plywood sector. There are indications that Canada will fall further behind, technology-wise, if research and development expenditures are any indication of future levels of technology. As seen in Fig. 6, we have historically spent less on R & D than our major competitors. The U.S. spends four times as much as Canada, Sweden three times as much, and Norway and Finland spend relatively more than we do.

Canada has some very serious labor/management problems. Historically, Italy has had the worst strike record in the western world; however, if we look at recent trends for 1980-82, Canada is now in the unenviable position of having the worst strike record (Table 2).

Looking more closely at individual sectors, we see that forestry is the third highest in days lost per union member (Table 3). Coupled with this poor strike record are recent trends in wage settlements that have Canadian forest sector wage rates increasing faster than their American counterparts.

Our major competitors are investing considerable effort in intensive forest management. There has been a significant increase in plantation forests in the United States, Scandinavia, Western Europe, Japan, South Africa, Australia, New Zealand and South America. The U.S. south, for example, is now working on their "Third Forest" while Canada is just beginning to initiate policies and programs to increase forest productivity. The major emphasis of recent programs has been on forest renewal; however, complementary programs in forest protection, supply of trained manpower, education and training facilities and research are needed.

Productivity is something that we are going to have to address to carry us over this interim period until we get to the point where we can start relying on the lower cost second growth forest. We are going to have to figure out ways of staying competitive during this interim period and productivity increases are the best way to achieve this. We are going to have to deal with higher relative production costs and this means that we are going to have to increase productivity. Microelectronics is one way that we can do this in order to increase our conversion efficiency and to extend the resource itself. In other words we have to increase utilization and also increase our total productivity — thus reducing unit costs.

So microelectronics has a major role to play and we are going to have to spend more time and effort on increasing productivity than the rest of the world if we want to try and hold onto our markets.

Conclusions

Cost competitiveness will be the key to future survival in world wood products markets. Although world demand is projected to increase by 50 per cent by 2004, there will an abundance of world forest biomass, particularly from countries that Canada trades and competes with. Canada will no longer be the dominant force in the scarce resource, but simply a major participant in an increasingly competitive environment.

Being cost competitive means addressing the productivity aspects of labor and capital inputs, conversion efficiency, labor costs, and raw material costs, i.e. total production costs. There are some strong indications that Canadian production costs vis-a-vis the rest of the world will be high for the following reasons.

- Delivered wood costs will increase faster in real terms because we are still relying on an increasingly inaccessible and lower quality old growth resource.
- Recent wage rate settlements and our poor labor / management relations mean higher unit labor costs.
- Technology levels in Canada may well be lower because our competitors are spending more on R & D.
- Our competitors are investing considerable effort in intensive forest management (plantation forestry), while we are still talking about the "possibility" of running out of natural timber.

Canada must put relatively more emphasis on productivity gains to carry us through the transition period of relying on natural timber to relying on second growth stands. We must find ways to compensate for higher relative production costs in the interim period. This means a concerted effort by government, industry and labor to work together. Increased productivity is the key — both in the forest and in the mills.

If we do not remain cost competitive, we will lose market share and this will be translated into lost jobs and income for Canadians. In addition, cost competitiveness is necessary to maintain an attractive investment climate which has a direct impact on capital spending, and thus on productivity.

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* * *

Table 1

Conversion Factors Relating Input of Raw Material to Output
(m^3 solid wood volume in the rough / m^3 production)

COUNTRY	END PRODUCT				
	Sawn Softwoods	Sawn Hardwoods	Particle-board	Plywood	Fibreboard
Finland	1.93	1.68	1.24	2.94	1.41
Norway	1.97	—	1.48	—	1.61
Sweden	2.00	1.84	1.48	2.54	1.74
Canada	2.05	2.26	0.96	2.71	0.79
U.S.	2.61*	2.09	1.45	2.22	0.80

* Production based on actual dimensions, all others are based on nominal dimension.
Source: F.A.O. Conversion Factors for Forest Products.

Table 2

Days Lost Per 1000 Employees (Yearly Average)

	1973 - 1982	1980 - 1982
Canada	914	834
Italy	1,211	752
Australia	705	730
Britain	471	374
United States	396	267
West Germany	40	9

Source: **The Financial Post**, August 27, 1983, p. 1.

Table 3

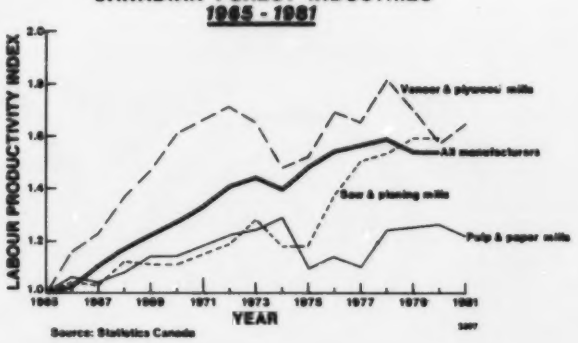
Days Lost Per Union Member by Industry, 1973 - 1982

	Days Lost Over Decade	Percent National Average
Fishing	138	475
Mining	118	421
Forestry	46	164
Finance	43	153
Construction	42	150
Manufacturing	40	143
Agriculture	33	118
Transportation	22	78
Trade	15	64
Service	12	42
Public Administration	9	32
All Industries	28	

Source: **The Financial Post**, August 27, 1973, p. 2.

Figure 1.

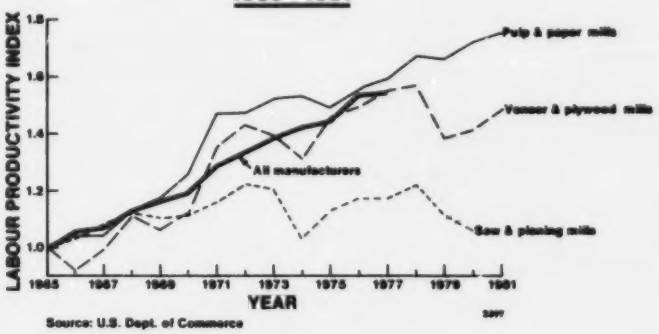
LABOUR PRODUCTIVITY IN THE CANADIAN FOREST INDUSTRIES
1965 - 1981



Source: Statistics Canada

Figure 2.

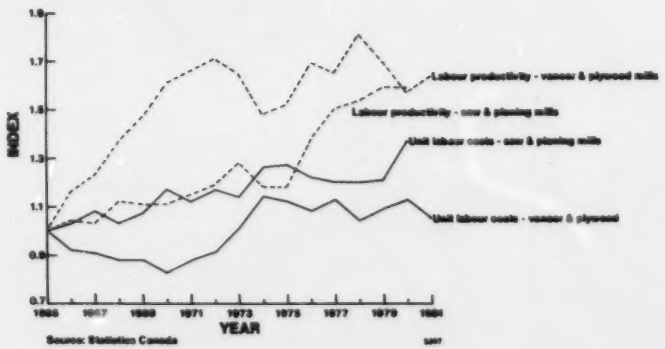
LABOUR PRODUCTIVITY IN THE U.S. FOREST INDUSTRIES
1965 - 1981



Source: U.S. Dept. of Commerce

Figure 3.

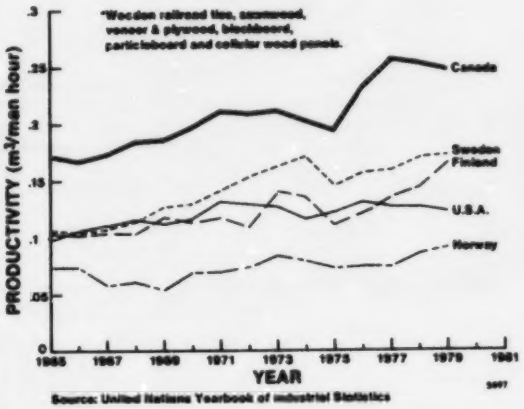
INDICES OF PRODUCTIVITY AND UNIT LABOUR COSTS - CANADA (costs in 1965 funds)



Source: Statistics Canada

Figure 4.

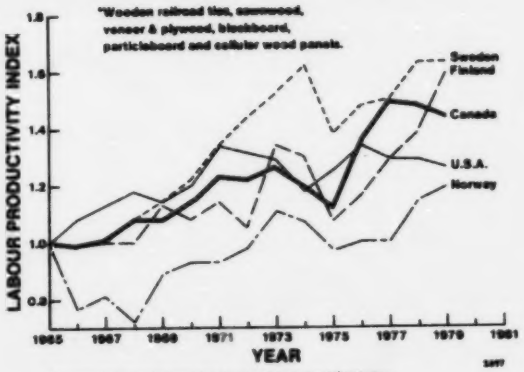
LABOUR PRODUCTIVITY IN SOLID WOOD PRODUCTS* (m³ per man hour)



Source: United Nations Yearbook of Industrial Statistics

Figure 5.

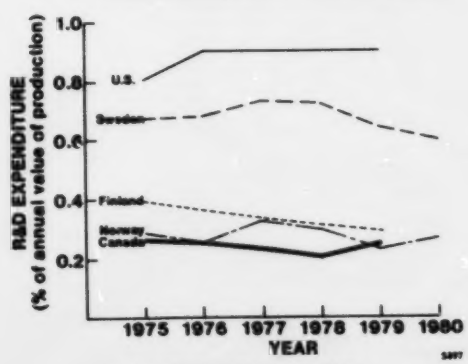
LABOUR PRODUCTIVITY INDICES IN SOLID WOOD PRODUCTS*



Source: United Nations Yearbook of Industrial Statistics

Figure 6.

RESEARCH AND DEVELOPMENT EXPENDITURES BY GOVERNMENT AND INDUSTRY IN WOOD BASED INDUSTRIES



Sources: U.S. National Sciences Foundation
U.N. Yearbook of Industrial Statistics
Dept. of Industry, Trade & Commerce, Canada

The Quality of Hardwood Products: Is There a Role for Microelectronics?

Peter M. Murray
Weldwood of Canada Ltd.

To people involved in softwood, quality is important but not as much as it is in hardwood production. Because of the wide range of value between the log and finished product, getting the maximum dollar return, through quality as well as production volume and yield, is critical to survival. The range in product prices is dramatic.

Logs - domestic veneer quality peelers and slicers run from $600 per mfbm down to $320 per mfbm.

Sawlogs - from $350 per mfbm to $130 per mfbm.

Firewood Logs - from $100 per thousand to $75 per thousand, all loaded on trucks.

And note that you can have this extreme in log quality and price develop in one tree. For example:

Lumber - at mill, green rough can run from $670 per thousand for fas 8/4 maple to hearts at $205 per mfbm and dunnage as log as $50 per mfbm.

Rotary Birch Veneer - select white whole piece at $170 per thousand square feet to reject backs at $35 per thousand square feet.

Again, quite a spread and all from the same log.

Quality is defined as 'grade' and a 'state of excellence' and it is in this context that I am using the word. In hardwood lumber the basis for grade is formed by the NHLA rules. Units of clear cuttings are measured by the lumber grader, the sum total of which defines the grade. Permissible wane, knots and defect are considered in the grade determination. The opportunity for grade and lumber value improvement is considerable, and improper edging and trimming can be very costly. As most hardwood lumber is sold rough, adequate allowance in the green lumber thickness must be made in the target size. Too thick and you lose yield, too thin and you downgrade the board. In veneer, thickness, drying, and grade, as specified in the HPMA rules, are integrated with component width requirements for the correct finished product. Any technology which can improve on the finished product while maintaining or improving productivity, must be considered in the manufacturing process.

It is the objective of any mill manager to obtain the maximum quality from the raw material, whether it be tree, log or lumber. He uses intuition, experience, customer acceptance and his P&L statement as inputs on decisions required to reach his objectives.

By now, we all know about the computer revolution, and "breathes there a manager with a soul so dead" that he hasn't asked on many occasions "can I use this stuff in my mill bush or plant? How much is it? Will it pay for me?"

Hardwood production is not big in Canada; Ontario, Quebec and some of the Maritimes in total, wouldn't exceed one of the large U.S. hardwood states. So basically we look to the south or Europe for what's happening in the industry.

There are a number of publications relating to the computer technology in which hardwood is one of the key words.

List of Papers

1967 USDA	A computer method for predicting lumber cutting yields, USDA obtain an accurate estimate of culling yields for any grade of hardwood lumber

1970 FPL USDA	Tomorrow - computer-made sawing decisions replace people decisions? A scanner can give the grade of a hardwood board in a quarter of a second.
1972 USDA	The computer can make the sawing decisions review of USDAtechnical paper ripping and crosscutting decisions during conversion of hardwood to dimension lumber.
1972 USDA	A computer program to determine the maximum value of hardwood sawlogs. "How much can a mill afford to pay for the logs."
1973 FPJ	Dimension stock yields from lumber of three hardwood species "useful in determining the quality of a specific cutting order from each grade and grade mix, by comparing product needs with raw material requirements for each combination."
1973 Sawmill Clinic	Computers in the mill environment. Chapter 12.
1974 Woodwork & Machinery Fair	Lumber manufacturing with automated scanning and computer equipment and material utilization control.
1974 Woodwork & Machinery Fair	Lumber manufacturing with automated scanning and computer equipment and material utilization control. Computer controlled-precision ball sawmill "gives phenomenal increase in wood recovery because they eliminate reliance on the judgement of the human operator. With automation, hardwood logs can be converted directly into furniture components without converting them first into lumber."
1974 Sawmill Clinics	Computer operated drives for log board processing. "Computer controls of set works with closed loop system. The sawyer chooses set, hits the set initiate button, and you get an improved yield and product."
1975 Furniture Production	Dimension and Plywood Inc., North Carolina. "Computerized mill using a single card for each panel configuration. 16,000 panel size combinations for which the computer can be programmed."
1975	Installation of a precision ball screw carriage with computerized set works. Potlatch Corp. Description of set-up and maintenance.
1979 USDA FPL	Simulation of hardwood log sawing. "Mathematical modelling computer programs for several hardwood sawing systems. One has judgement capabilities." These models are the basis for further sawing methods in terms of lumber value yield. Two companion papers are "lumber values from computerized simulation of hardwood log sawing" and "programs for computer simulation of hardwood log sawing."
1981 USDA NE Forest Experimental Station	Simulated sawing of squares, a tool to improve wood utilization. "The manufacturer can choose which bolt sizes to use for sawing squares based on sawing method used, the range of bolt diameters available and the size of the square to be produced."
1981 FPRS	Feasibility projection for a sawmill furniture dimension plant using low grade hardwoods."Using the optimum furniture cutting computer program, a simulation using conventional machinery for a dimension plant is costed out."
1981 FPJ	Lumber complex of the future: log processing. "Future log processing systems will be versatile." Microprocessors will provide increasing levels of direct process control. Scanners and sensing equipment will characterize internal and external log defects, measure log volume and code this information for computer applications. Reduced kerf and increased saw blade stability will be accomplished using electromagnetic and heat induction saw guides and dynamic tensioning devices.
1982	The weak-link hand held calculator program. Logging system analysis. By use of this small programmed computer, production equations, model conventional, chain saw, skidder, loader and tandem axel truck operations. The final output is logging costs in dollars per mfbm. This machine is used in conjunction with the 'weak-link logging system analyzer'.Unit is the Hewlett Packard 41C calculator.

1983	Afraid of personal computers? See Sandwell of Sandwell & Associates. "Every manager, from foreman to president has some tasks that can be made easier by using a micro." "What we do know is that sophisticated machines are now essential to produce accurate, high quality lumber people are still the key."
1983	Moving into the electronic age computer numerically controlled machines. This article (from an English trade journal) identifies the use of computer controlled secondary manufacturing machinery in the furniture business.
1983	There are a number of articles to guide the manager into effective (and productive) use of the micro: (1) Check list to help you evaluate microcomputer software; (2) Recovering computer costs tricky; (3) Are you trying to select a computer?
1983	Some quotes from articles on computerizing of sawmills, primarily softwood, but still applicable to the hardwood business. "A simulation package has been designed to help sawmill managers make better decisions by accurately predicting the effect of an operation variable change in a given mill. A considerable commitment by sawmill managment in terms of time and resources is needed." "By automating and optimizing machine centers, sawmills can increase yield from each log, increase mill efficiency and enhance final grade quality of lumber." The article then proceeds to outline the considerations to be taken into account before purchasing an optimizing system.

I don't doubt that there are papers pre-dating 1967, and many more since of which I am not aware. But what I've noted, indicates that there is technological expertise available for the hardwood manufacturer if he knows where to look and what to look for.

I might make a suggestion here that a clearing house, perhaps Forintek, could serve to put the potential customer in touch with reputable manufacturers, consultants or researchers.

I will now continue the topic using inputs of personal knowledge and that of associates in both machinery manufacturing, sawmill, veneer mill and secondary manufacturing fields.

Frank Petro has an excellent publication "Felling and Bucking Hardwoods for Improved Profit." I question that this system can be significantly improved by computer simulation. However, the rapid input of log manufacturing data into a micro computer would permit frequent, quickly available reports on log lengths, grades, etc. that would enable a standard of log quality to be maintained. The quality hardwood timber supply in Canada, has diminished as virgin stands were cut on the diameter limit basis. Currently, marking predicated to a selective cutting prescription is upgrading the residual stand at the expense of currently available quality logs. Although not all hardwood bush is marked, a high percentage of the total available on both crown and freehold land is under some form of marking management.

It would be some time before the fruits of our current marking systems make available to the mills a higher quality tree. In the meantime, mills and operators must adapt themselves to the manufacture of quality products from a lower quality tree.

Computer technology has been used in hardwood inventory from cruise data by log grade, species, etc. This can, if the cruise itself is reasonably reliable, enable a quick print-out on log grades to be expected from a block. It's a base line for actual production.

I don't doubt that a log scaler hand held electronic tally book, if I can use that term, could be programmed to indicate what grade to put the log into, E.G. 3 or firewood, as it simultaneously records the footage, defect from gross, gang identification, etc. Feed the stored information into a printer and you have the day's work quickly in hand.

Production, maximum grade recovery and maximum yield are the three prime objectives, big mill or small. There aren't that many large hardwood mills in Canada, and it is certainly a fact of life that the degree of electronic sophistication is directly dependent on a volume of production necessary to write off the capitalization. One U.S. researcher suggested that hardwood mills will have to reach 150 to 200 mfbm per shift. This won't be practical in Canada for the volume of timber is just not available.

Neither of our Weldwood hardwood mills, or any hardwood mills that I am familiar with, have any on-line computer technology. Some of the available softwood systems could be adapted, such as the edger optimizer. The lower feed thru production (compared to the softwood mill) may well be offset by the dollar increase in grade and yield recovery. Note that an increase in yield of one per cent and a lumber value of $1 per thousand would mean an additional $40,000 in

revenue at no additional cost on a 10,000 mfbm annual production. So there are dollars to work with if the initial costs fall within an acceptable rate of return. I can see where a sensor tied to the headrig breakdown, could assist a sawyer with a digital readout indicating the best cut in thickness and location. There are digital readouts on the console now, but nothing as yet to my knowledge that advises the sawyer of what is the next best move. Caution here though; an experienced sawyer must use such information as a guide and not as the 'last word'.

I asked a manufacturer of sawmill equipment if in-place sensors could warn maintenance staff of wear limits on various mill components. Such a system could enable closer tolerances and reduced target sizes and higher yields. These sensors, coupled with a computer printer would have the basis for preventive maintenance program that would reduce downtime and produce a close tolerance lumber, veneer or dimension. When asked where he would go for hardwood expertise, if asked by a client for an electronic mill, he said "Europe they're well ahead of us there". He noted particularly the thin kerf saws where you get the highest return for minimum dollar expenditure.

Scanning 'board graders' are a fact. How well they work, I don't know, but if applicable, they might be applied to the trimmer where it is felt more dollars are lost than at any other center. They might also give more accurate boardway grading, be instrumental in a sorting system and supply almost instant feedback to the mill foremen and superintendent.

In the veneer business, I know that some American and European mills have carried technology well beyond that generally found in Canada. The objectives are the same as the sawmill: maximum production, grade and yield. Consider some of the conversion points:

Conditioning - plugged into a computer to get the best control of steam, water deluge and core temperatures.

Debarker - defect detection by sonar, allied with centering of the chucks would put the best block to the lathe. Thickness, manufacturing defect (chatter) splitting, etc. could be continuously monitored at the lathe.

Drying - compartment sensing coupled to variable drives would ensure, within limits of sap and heartwood, the desired moisture content percentage.

Clipping, defect, book and reclip could obviously benefit from scanners. Softwood mills are now equipped for auto-clipping can the hardwood mills be programmed as well?

Inventory control, quick calculations of grade preference for the clippers can be outputs of a plant micro or mainframe terminal all with the objectives of getting more from the log.

In the furniture and remanufacturing plants, a number of papers refer to scanning sensors as the basis for maximum yield on the cut-up lines. These are in place and have proven results. The key again is for maximum grade and yield from a given raw material base.

Kiln drying, a long and costly process for high grade hardwoods is being tied into remote sensing that controls the temperature, wet bulb depressions and automatically conditions and turns off the kilns when the charge is finished. This can improve the quality of the lumber by reducing drying defects and, no doubt, speed up the process, thus making more kiln time available.

In summary, yes, there is a place for microelectronics in the hardwood business. Yes, quality and product from diminishing raw material base will take every available input, human and mechanical, if the Canadian producer can be competitive.

Yes, there is currently available, technology that can be adapted in varying degrees to the manufacture of hardwood products.

But can the hardwood business afford to install sophisticated equipment similar to that in high production softwood mills? Where do we go for the answers?

There are many forms of assistance for the mill owner that are not too costly. The micro computer can aid him in data processing; keeping him informed on what's going on, is it paying, and presenting data to make valid decisions. The application of computer simulators can assist in getting more quality from the raw material. Information is also available to assist his employees in adapting to the need for improved productivity and quality.

In short, the sooner we in the hardwood business take a closer look at what we are doing, and start using existing expertise and equipment and adapt rapidly to advances in the field, the better we stand a chance of being around to enjoy the fruits of the computer age.

* * *

Room for Improvement in Canadian Sawmills

In his opening remarks, R.W. Stephens explored the need to update Canada's wood product manufacturing facilities. The content of his introduction was based upon the following paper, authored by Forintek's economist, Dr. A.T. Schuler, and the main part of his presentation was derived from a paper entitled "Room for Improvement: a discussion of machine centre inefficiencies based upon sawmill improvement studies performed by Forintek", authored by W.F. Love of Forintek's Lumber Manufacturing Technology Department.

In the interests of providing the reader with complete information, we are publishing both papers in full.

* * *

Room for Improvement

A discussion of machine centre inefficiencies based upon sawmill improvement studies performed by Forintek.

W.F. Love
Forintek Canada Corp.

We — and I am speaking now for the sawmilling group at Forintek — feel that profitability at each and every sawmill can be improved with little or no major capital investment. There are some very good mills out there, but there is always room for improvement. This paper sets out to identify those areas we have found in our work where improvement can be made in most mills. We, as a sawmilling group, have studied 62 individual log breakdown systems in 47 different sawmills under our Sawmill Improvement Program (SIP). At this point, I will outline some background on this program for those who may not have heard of it.

The SIP program was originally initiated by the Eastern Forest Products Laboratory of the Federal Government and was expanded in 1979 following the formation of Forintek. The objective of this program has been to identify areas where improvements could be made to an existing operation. As well, we try to estimate the benefits associated with these recommendations so that improvements with the greatest financial return are easily identified. In the past, many of these improvements would require additional manpower and capital.

Today, however, the diminishing cost of process control equipment and its adaptability make it a great tool for improving any existing operation. I would like to look at some examples from the work we have done to illustrate where there is room for improvement. These examples involve improvements in productivity or recovery because they are one and the same when you get to the bottom line.

We have identified five major areas where we feel there is usually room for improvement in an existing operation. We call this the Road to Improved Recovery and Productivity.

As you can see, the five areas are:

- Improving Log Quality
- Improve Log Allocation
- Optimize Log Breakdown
- Minimize Lumber Size
- Improve Productivity

All five have a significant effect on the overall profitability of the sawmill. Improvements can be made in each of these areas with little or no capital investment.

Improving Log Quality Entering Mill

Here we are talking about all the operations which affect the log before it is actually processed. These operations are important because any efforts here can't be corrected in the mill. Slashing has a tremendous impact on the final product yield. Poorly slashed logs invariably result in reduced recovery and productivity. The important points tc consider in checking log quality coming into your mill are:

- sweep
- crook
- log length
- overlength
- debarking

The first two, sweep and crook, we all know are a problem in that they reduce recovery and productivity. Computer controlled bucking systems should reduce this problem in the future. The other three points are:

- log length
- overlength
- debarking

These are less obvious but shouldn't be overlooked as they affect profitability. How much? Well, let's have a look at an example considering the first two, log length and overlength. Just so we are talking about the same thing, let me define what we mean by log length and overlength.

- Log length: here we are speaking of producing the correct log length for the lumber sizes marketed. In other words, producing the correct nominal length log plus the minimum trim allowance required.

- Overlength: is any length in excess of the sum of the nominal log length plus the required trim allowance.

To illustrate what we mean, we have the case of the mill selling lumber on the even foot (8-10-12-14-16). Measuring the logs we find a log cut 12 feet 9-1/2 inches. In this case, the log should have been cut 12 feet/5 inches. As cut, this log has 4-1/2 inches of overlength. Another log is 11 feet 10 inches; this log length is not desired. In this case, the overlength would be 11 feet 10 inches - 10 feet 5 inches 17 inches.

This is an extreme example, but logs such as this, which are bucked just short of the nominal length, are especially detrimental because lumber must be trimmed back to the next nominal length which is usually two feet. This represents 12.5 per cent on 16 foot lumber. Excessive overlength and improper log length are costly.

Firstly, lumber recovery is lower from these logs as this extra length is usually trimmed off and chipped. No additional lumber is produced from the overlength.

Secondly, this extra log length consumes expensive processing time without producing any additional lumber. This reduces throughput and increases processing cost per log.

Finally, producing the correct length initially would occasionally allow a longer last log to be cut from the tree length. It also results in a slight increase in the small end diameters of subsequent logs. Occasionally, this diameter increase will put this log in the next higher diameter sort class resulting in increased recovery. During one study, we found the trim allowance on the study logs averaged 6.9 inches if odd log lengths were acceptable. As the mill was not producing odd length lumber, our average trim allowance increased from 6.9 inches to 8.6 inches. Now, let's assume all the logs could be cut the proper length and with, say, an average trim allowance of 5 inches. The excess overlength 3.6 inches (5.0 inches to 8.6 inches) would be saved and lumber recovery would improve as shown in Table 1.

You can see that eliminating the overlength produced a 1.7 per cent increase in the Lumber Recovery Factor (LRF). What does that mean to an operation cutting 25 MMfbm/year? (Table 2).

The 1.7 per cent increase in recovery translates into the production (425 Mfbm) of additional lumber from the same sawlog resource. There is no additional resource or sawing cost associated with this additional lumber. In calculating the value, we have assumed a shrinkage and planer mill loss of six per cent. As well, we subtracted $14/Mfbm for drying and $26/Mfbm for planing from our selling price of $240/Mfbm. The lumber value increase totals about $80,000. When we subtract the value of the lost chips, we obtain a net benefit of almost $50,000 per year.

The third point under log quality refers to debarking. A lot of money can be made or lost at the debarker. Too much bark in the chips and you lose the premium or, worse yet, the chip contract. Too much fiber removed here is lost for good. Complicating this matter is the desire to increase lumber recovery. If we increase lumber recovery, less wood fiber will end up as chips from a given tree volume. If debarking efficiency does not increase at the same time, then the relative percentage of bark will increase in the chips. There is a fine balance here between too much and not enough. If we haven't achieved this balance, how much can it cost? We used the Best Opening Face (BOF) program to simulate the effect of log diameter reduction due to excessive debarking.

A 6.4 inch diameter log, 12 feet long with two inches of taper should yield 27 fbm of lumber if the log is sound and straight. This is based on the BOF sawing solution for split taper, log and cant sawing and a 1.875 in. target size (Table 3). You can see here that if the debarker is removing a tenth of an inch too much of good fiber, that same log would yield 11 per cent less lumber. What can this mean to our operation producing 25 MMfbm per year? (Table 4)

Let's assume that we do not recover the full potential of 11% on every log. Let's assume four per cent, or say one log in three. The same logs should yield an extra 916,000 board feet of lumber. Using our net value of $200/Mfbm to allow for drying and dressing of this additional lumber, this lumber is worth $183,000. What the net benefit to the operation would be is very dependent on how well we can balance our bark and chips, but it is certainly worth a look. Don't forget that we only increased lumber recovery on every third log. There would be additional wood fiber on the other two logs which might be recovered as chips.

The next major area I want to discuss deals with Log Allocation. In this area, we are looking at

- yield or lumber recovery by production line;
- productivity by production line; and
- profitability by diameter.

The first two obviously involve the case of optimum allocation of sawlogs between two processing lines. This is a very important step in any two-line mill. Logs must be processed to achieve maximum overall mill recovery and productivity.

We feel, however, that log allocation is just as important in a single line mill. It is important to process only profitable logs. I would like to share two examples with you to illustrate these points.

The first example involves the two-line mill. One line was for logs less than seven inches while the other line was for the larger logs. During our study, ten per cent of the logs on the large log line were under the seven inch sorting guideline and 20 per cent of the logs on the small log line were over the seven inch sorting guideline.

The optimum allocation between the two lines is shown in Table 5.

You can see that proper allocation of logs between the two lines would increase the overall mill Lumber Recovery Factor by four per cent. Based on an annual production of 48 MMfbm, this increase would result in the production of an additional 1,930,000 fbm of lumber from the same sawlog volume (Table 6). Again, we have assumed a drying and dressing cost and allowed for shrinkage and planer mill losses in coming up with the additional lumber value of $363,000.

There will be a loss of chip revenue but the next benefit to the operation was still calculated to be over $200,000 as can be seen.

How about that single-line mill? If you remember, for that mill we were talking about profitability by diameter. What are the potential benefits?

These are log sizes in mills which are processed and produce no lumber. This is a very expensive way to make chips. There are also log sizes which, because of their small size, require far too much expensive headrig time per Mfbm of lumber. The result is log sizes which are processed at a loss. The production cost for these logs far outweighs the product value generated by those same logs. Table 7 shows us an example of this situation.

Before anyone gets nervous, these numbers were calculated at the bottom of the recession. Since then, lumber prices have risen but this operation still has to process about 280 three inch diameter, eight foot logs to produce a thousand board feet of lumber. The mill did not have any more available resource. Any decision, therefore, to chip these logs would reduce annual lumber production. The result of chipping rather than sawing those unprofitable logs is shown in Table 8.

As you can see, the decision to chip those two small diameter, short length sawlogs saved enough in sawing costs to produce a net benefit of just over $100,000 per year. This operation did not have to make any investment to facilitate chipping of these logs.

The benefits would be significantly higher, however, if larger, profitable logs could have been processed in place of those small logs which were chipped.

Optimum Log Breakdown

We all know the cost of delivered wood is rising and of the need to maximize recovery. We have already seen examples of the potential benefits available due to small increases in recovery. The important point is that the log breakdown process is only one step that affects the final yield. You could have the best computer controlled log breakdown system, but it will only be as good as the processes before and after it. Computerized headrigs are very good in that they minimize the chance of losses due to operator error. As well, it can allow management the opportunity to optimize on value which can be a big advantage in terms of marketing.

But any computerized log breakdown system will be very dependent on two important factors:

- efficiency of the scanning system;
- efficiency of diameter sorts to sawing diagrams.

Remember the 11 per cent difference in recovery at the debarking stage due to the difference in diameter? The same thing can happen at the headrig if scanning or sorting is less than ideal.

Minimize Lumber Size

What we mean here is producing the smallest possible rough, green size required to give us the final dry, dressed market size. To achieve this, we have to think about three things.

- sawing variation
- target size
- quality control monitoring

We have to establish a realistic minimum target size. Then we have to stick to it, not just for a week, but on an ongoing basis. Therefore, we need quality control. If we follow these steps, our target size should allow us to eliminate any oversizing.

Figure 1 shows what we mean by oversizing. We carry out thickness analysis to determine sawing variation. Once we know this, we start with our final market size and add to it. We add allowances for planing, shrinkage and sawing to come up with the minimum target size. The amount (either thickness or width) by which our lumber exceeds this target size is called oversizing. This additional fiber is lost as lower valued planer shavings. What we want to do is eliminate this oversizing so that this fiber may be recovered as additional higher valued chips and lumber. It is doubtful in eastern Canada that elimination of oversizing will result in the production of extra boards because of the small log diameters. However, elimination of oversizing can result in the production of longer, wider or thicker pieces of lumber.

Figure 2 shows how the elimination of oversizing increases lumber recovery. In this example, the elimination of less than 1/16inch in the target size allowed the length of the top two by four to increase from 12 to 14 feet. This translates to a recovery gain of 2.6 per cent.

Most mills target 17/8 inch for two inch lumber; some mills go down to 113/16 inch, but this is about the lowest we see. With proper quality control checks and low sawing variation, we have generated some target sizes as low as 121/32 inch (1.656). Our colleagues at the Western Laboratory in Vancouver are now seeing target sizes on gang edgers and Chip-N-Saws of 111/16 inch (1.687) to 123/32 inch (1.718).

What does this mean to an eastern Canadian operation cutting 25 MMfbm a year? Let's assume that after a lumber size evaluation, the company finds they can reduce their target size from 1 7/8 inch to 1 13/16 inch. In other words, reduce oversizing by 1/16 inch. Let's also assume that only one-third or 33 per cent of this oversizing is recovered as lumber and the remaining two-thirds as chips. The benefits of this change are shown in Table 9.

Based on a production of 25 MMfbm (rough green), the reduction in oversizing would result in the production of an additional 213 Mfbm of lumber with no increase in sawlog volume. This lumber, after allowing for shrinkage losses plus drying and dressing costs, would have a value of over $40,000. Adding the value of the additional chips results in a total net benefit of $68,000 annually.

My last topic is improving productivity and two factors need to be considered.

- Down time
- Delay time

Productivity is the "name of the game" and down time is crippling in terms of cost, but what I would really like to discuss is delay time. This is different from down time. Down time affects the time during a shift when a machine is available for processing. Delays, on the other hand, are short duration interruptions when the machine is available but not actively processing material due to operational or mechanical problems in the mill flow. It reduces the rated capacity of a machine, it can lead to operator frustration, and it is much harder to detect.

Because they are short duration delays, they are easily overlooked during a shift but they sure affect the total production. Delays that we have meausred at the headrig have ranged from less than one per cent to over 17 per cent. Usual causes for delays at the headrig include:

- lack of material;
- log handling delays;
- log jams at unscrambler;
- surge deck overloaded downstream;
- chipper jam.

What do delays cost? (Table 10) We have assumed that we could reduce delays by ten per cent with minor modifications. This would increase production by at least ten per cent as delays only affect the productive machine time. When we amortize the sawmill operating cost over the increased production level, there is a $7.27/Mfbm decrease in sawing cost. On an annual basis, this amounts to a $199,925 savings. The only cost involved would be the cost of any modification.

That concludes my run through the mill. The total benefits are shown in Table 11.

You can see that some sizeable benefits are available to our operation cutting 25 MMfbm a year. A lot of these improvements require some hard work, applying a little science and lots of common sense, but there is room for improvement.

* * *

Table 1

Current Milling Conditions

	Log Volume (cf)	Lumber Tally (bf)	Lumber Recovery Factor	LRF Improvement (%)
Study Logs With Overlength	2847.2	18,222	6.40	—
Study Logs Without Overlength	2798.8	18,222	6.51	1.7

Table 2

Benefits From Reduction in Log Overlength

Annual Production	25 MMbf
LRF Increase	1.7%
Additional Lumber Volume	425 Mbf
Additional Lumber Value at 425 × .94* (240 - [14 + 26])	$79,900
Reduced Chip Value $\frac{425{,}000}{12\text{bf}} \times \frac{45.6}{2000} \times \$70/\text{ODT}$	$31,700
Net Benefit	$48,200

* shrinkage 6%

Table 3

Increase in Lumber Yield Using Correct Debarking Technique

Log Diameter (in.)	BOF* Yield (bf)	LRF	Difference (%)
6.4	27	7.22	—
6.2	24	6.42	11.1

6.4 log
12 foot long
2 inch taper
split taper log and cant sawing
* based on a target size 1.875

Table 4

Benefits Using Efficient Debarking Technique

Annual Production	25 MMbf
LRF Increase	4%
Additional Lumber Volume	916 Mmfb
Additional Lumber Value at 916 × .94* (240 - [14 + 26])	$172,200
Reduced Chip Value	—
Net Benefit	$183,000

* shrinkage 6%

Table 5

Potential Lumber Recovery Improvement

	Small Log Line LRF	Large Log Line LRF	Mill LRF	Improvement (%)
Study Log Allocation	5.51	5.98	5.77	—
Optimum Log Allocation	5.64	6.31	6.01	4.0

Table 6

Benefits From Improved Log Allocation

Annual Production	48 MMbf
LRF Increase	4.0%
Additional Lumber Volume	1,920 Mbf
Additional Lumber Value at 1,920 × .94* (240 - [14 + 26])	$36,000
Reduced Chip Value $\frac{192,000}{12bf} \times \frac{25.6}{2000} \times \$70/ODT$	$143,000
Net Benefit	$218,000

* shrinkage 6%

Table 7

Net Product Values ($/Mbf)

Log Diameter Class (inches)	Log Length 8 feet	12 feet	16 feet
3	-215	-109	-61
4	-174	-143	-40
5	-40	13	39
6	7	37	46
7	42	57	70
8	75	—	92
9	86	—	121
10	101	—	—

Table 8

Benefit of Chipping Some Unprofitable Sawlogs*

Processing Logs for Lumber		
Annual Production	25MMbf	
Chip Production (ODT/year)	1,420	
Total Product Value ($/year) (Lumber, Chips, Residues)	308,500	$308,500
Processing Logs for Chips		
Chip Production (ODT/year)	2,920	
Value of Chip Production ($/year)	225,000	
Savings in Sawing Costs ($/year)	177,600 (49 shifts)	
Savings in Planing Costs ($/year)	20,300	
Total Value of Chipping ($/year)	422,900	$422,900
Net Benefit (Chipping)		$114,400

*chipping 3 and 4 inch diameter × foot sawlogs

Table 9

Benefits from Reduction in Oversizing Lumber

Annual Production	25 MMbf rough green
LRF Increase	1.1%
2 inch Lumber Production	80%
Additional Lumber Volume	213 Mbf
Additional Lumber Value at 213 x .94* (240 - 14 26)	$42,600
Additional Chip Value at 427 ODT x $60/ODT	$25,600
Net Benefit	$68,200

* shrinkage 6%

Table 10

Benefits from Reduced Delays

Annual Production	25 MMbf
Operating Cost (Sawmill Fixed and Variable)	$2 MM
Sawing Cost/Mbf	$80/Mbf
Delays	10%
Additional Lumber Volume	2.5 MMbf
Reduced Sawing Cost ($80/Mbf - $2MM / 27.5 MMbf)	
Sawing Cost Savings ($7.27/Mbf x 27.5)	$199,925
Net Benefit	$199,925

Table 11

Total Benefits for a 25 MMbf Sawmill Operation

Elimination of Overlength	$48,200
Improved Debarking	183,000
Improved Allocation	114,000
Minimize Lumber Size	68,200
Reduce Delays	220,000
Total Net Benefits	$633,400

FIGURE 1.

THE COMPONENTS OF A TARGET SIZE

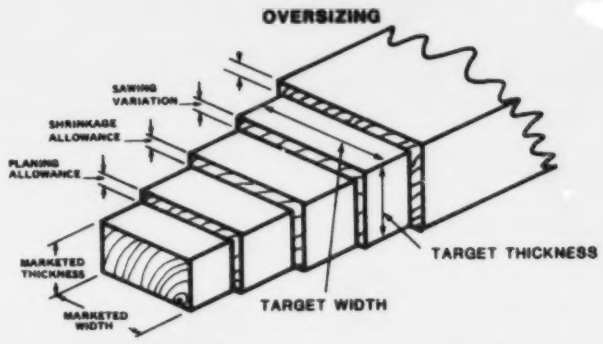
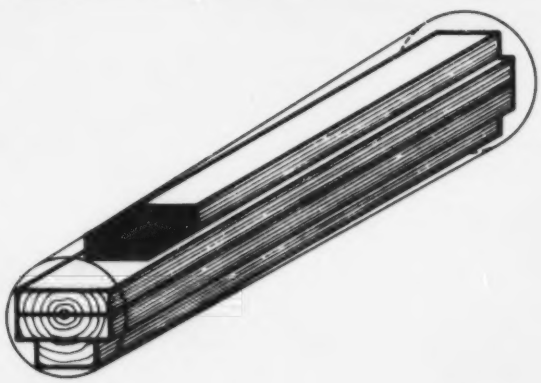


FIGURE 2.

ELIMINATION OF "OVERSIZING" OR THE REDUCTION OF LUMBER THICKNESS TO IMPROVE LUMBER RECOVERY



Merger of Industry, Trade and Commerce (IT&C) With Department of Regional Economic Expansion (DREE)

Robert Renaud
Department of Regional Industrial Expansion

As you no doubt have heard, Industry, Trade and Commerce (IT&C) and the Department of Regional Economic Expansion (DREE) have merged. The new name has been approved by the House of Commons; we become the Department of Regional Industrial Expansion (DRIE). When the departments were merged, several of the programs were also merged. The new Industrial Regional Development Program (IRDP) becomes the main instrument IT&C/DREE uses to provide assistance to industry. There are six other programs left, though, as shown in Figure 1.

IRDP will be the core program through which the majority of federal business assistance money will flow; other programs exist but by the end of 1984 IRDP will be virtually the only way this group will get federal assistance. The Federal Business Development Bank will still be around, of course. The majority of assistance continues to be directed to manufacturing and processing firms.

Assistance under the Industrial Regional Development Program raises the following questions:

- What money is available?
- For what projects can we get money?

The answers are:

- Depends on the region.
- Depends on the project.

Figure 2 deals with the following points:

- The sharing ratio - percentage of participation of the federal government.
- The six program elements of IRDP.
- The four tier levels. The whole country is divided into Tiers; the Tier rating provides the skewing of assistance to disadvantaged areas.

Tiers

- What money is available and for what?
- Tier levels determine the sharing ratios.
- Cochrane district is a Tier II.
- Temiskaming District is a Tier III.
- No Tier IV in Ontario.

IRDP Elements

- Climate - municipalities infrastructure, etc. (of no interest to this seminar).
- Restructuring - critical case and bail out (of no interest to this seminar).
- Marketing - to be determined later; the federal government has to develop guidelines so nothing at the moment.

- Establishment - new facility, new plant. Talk to us if you are thinking of a new plant but, with plant capacity and utilization being what it is, the federal government will take a long hard look before providing assistance, and we expect to spend decreasing amounts of federal money under the establishment element.

We are left with innovation and modernization/expansion. This is where the federal government expects to spend the bulk of its business assistance money through IRDP. Under modernization/expansion we have a component for adaptation of microelectronics technology as follows:

- "Funding may be provided to manufacturers and processors for the first installation of microelectronic devices in their products and operations, for the design of custom microelectronic devices, and for incorporation or application of electronic dependent products or systems in products, processes, production methods or facilities."

And look at the sharing ratio: Tier I - 50 pvr cent; Tier II - 60 per cent; Tier III - 75 per cent. That is the federal share maximum, of course, subject to negotiations but significant I would say for first time installation of microelectronic devices.

What costs qualify? Let me read directly from the regulations:

"The minister may make a contribution to a commercial operation in respect of the eligible costs of a project that expands, modernizes or enhances the productivity of the commercial operation through:

- The first incorporation or application of microelectronic devices.

- The design of custom microelectronic devices for incorporation or application in its products, processes, production methods or facilities.

The minister may make a contribution in respect of the cost of engaging a qualified consultant to perform a study concerning the feasiblity of a proposed project."

What if you are not a first time user. Are you prevented from getting assistance? No, although you won't get as much, you get the usual modernization/expansion assistance (Figure 3). The sharing ratios are not as high 35 per cent and 50 per cent and again these are maximums. I suspect 20 per cent will be a frequently used figure. Of course, you can get higher than 35 per cent and 50 per cent for the study part of the project.

Referring back to Figure 2, what form will this assistance take? Repayable contribution for capital assistance and implementation costs and non-repayable contribution for studies, although again everything is negotiable up to the maximum. We will look at risk. The first entrant always gets more. If you are at the tail end of a stampede, then you would get a lot less, possibly no assistance.

With all this negotiation and the departure from formula assistance, what will the federal government base its decisions on? These are the key issues we are addressing:

- Productivity and Innovation - first and foremost

- Market Development - export and/or import

- Industrial Renewal - build on our strengths

- Regional Industrial Benefits - frequently the lumber mill is the major employer in an area, a consideration that is so overwhelming that it frequently goes without mention

This assistance is not tied directly to jobs created like the traditional DREE programs, and under modernization/expansion we know that there is frequently labor adjustments needed. It will be a subject covered when you see us for assistance. Canada Manpower Consultative Services (soon to be renamed Labour Marketing Development Program) will consider these aspects of an assistance application.

In conclusion, there is substantial federal money available for the introduction of microelectronic services and microelectronic methods in mills because:

- You have the right industry for assistance

- You are in the right location for assistance, and

- The probable results of incorporating such devices are consistent with stated federal government objectives

I think and sincerely hope that we have the right program for you.

* * *

Figure 1

Industrial Regional Development Program (IRDP)
- new core program

Program for Export Market Development (PEMD)
- for new foreign markets and buyers coming in
- $2,000 to $5,000 assistance

Defence Industry Productivity Program (DIPP)

- special purpose
- defence industries

Business & Industrial Development Program (BIDP)
- special purpose
- textile and footwear
- Cornwall & Hawkesbury ends 1984

Regional Development Incentives Act (RDIA)
- good through 1984; C.P. before 1985
- old DREE assistance; most funds to northeastern Ontario flowed through RDIA; still available

Northern Ontario Rural Development Agreement (NORDA)
- project under $200,000
- ends March 1984
- rural employment component tied to jobs created

Figure 2

Program Elements	Eligible Projects/Activities	Maximum Level of Assistance Tier I	Tier II	Tier III	Tier IV
Industrial Development Climate	Economic Development Studies; Establishment of non-profit centres or Institutions	eligible	eligible	eligible	eligible
	Industry Infrastructure	not eligible	eligible	eligible	eligible
Innovation	Consultant Studies on Technology Transfer, Project Feasibility, Market Research, Venture Capital Search	50%	60%	75%	75%
	Development of New Product / Processes	50%	60%	75%	75%
	Development of Technology Capability	50%	60%	75%	75%
	Design, Development, Demonstration, Engineering	50%	60%	75%	75%
Establishment	Consultant Studies on Projected Feasibility, Market Research, Venture Capital Search	50%	60%	75%	75%
	Buildings, Machinery, Equipment, Related Infrastructure	not eligible	35%	50%	60%
Modernization / Expansion	Consultant Studies on Projected Feasibility, Market Research, Venture Capital Search	50%	60%	75%	75%
	Modernization: Machinery and Equipment	25%	35%	50%	50%
	Expansion: Buildings, Machinery and Equipment	25%	35%	50%	50%
	Adaptation of Microelectronic Technology	50%	60%	75%	75%
Marketing	Consultant Studies: Collection / Dissemination	50%	60%	75%	75%
	Non-profit Organizations for Market Research and events to promote Canadian Products	eligible	eligible	eligible	eligible
Restructuring	Consultants Studies on Project Feasibility, Market Research, Venture, Capital Search	50%	60%	75%	75%
	Restructuring (Loan Guarantees)	eligible	eligible	eligible	eligible
	Restructuring (Repayable)	25%	25%	25%	25%
	Participation Loans	not eligible	eligible	eligible	eligible

Figure 3

Modernization

Assistance may be made available for the new, advanced machinery which significantly enhances the productivity of existing activities in manufacturing and processing operations.

Expansion

Assistance may be made available for the expansion of existing manufacturing or processing production facilities.

Availability	Maximum Sharing Ratios
Tier I	25%
Tier II	35%
Tier III	50%
Tier IV	50%

Electronic Sorting

W.A. Seaman
Great West Timber Ltd.

I think that all of you know that sawmills have searched over past years for new ways to lower costs and remain competitive in the ongoing competition of the market place. The answer, for many, has been better logs, better log supply and, for most of us, spending borrowed dollars on new equipment to update processes for our sawmills and planing mills. Actually, as far as I know, there are only two ways you can improve your profits in a sawmill: increase productivity and production per man-day and increase the knowledge of your operation which means monitoring and gathering your information. You hear a lot of people say that if they could put in new equipment, they could cut a man out here and a man out there. We have never gone that way we have gone the other way. We have put in new equipment not to reduce the manpower but to increase the man's productivity. For us it has worked out very well.

Now this new technology electronics. In the early 1960's other industries were introducing new electronic technology when we were not. Industries such as mining and railroads were learning to monitor their operations and gather information through the use of electronics. The timber industry started to do it, I would say, in the early 1970's. We then started using many of the techniques that these other people had developed.

At Great West Timber in the early 1970's labor was beginning to be a problem, especially on the green chain. After the war we were getting about 15,000 feet per man-day on the green chain stickered and piled and by 1972 it was down to 6,000 feet per man-day stickered and piled, and poorly stickered at that. We heard about the new sorter that had been developed in the States. This one happened to be in Waycross, Georgia. We decided to go down and see it. We had put in an order already for a jaybar sorter in Salmon Arm, B.C. but somebody had told us to go down and look at this other one. We went down to Waycross, Georgia and we saw one of the first Harvey sling sorters. It was the difference between a horse and a car. The potential was just so great that we returned and cancelled our order in B.C. with their blessing because they were really busy at the time. Then I went down to Hot Springs, Arkansas and sat down and had a talk with Harvey. Consequently, we ended up buying, installing and owning the first Harvey sorter in Canada and we have never been sorry. At that time the one we bought had a ball-bearing memory system and even the guy who sold it to me could not explain it. Later Harvey developed a more astute system using computers. He insisted on taking back his ball-bearing sorter and installing the computerized module that he had to go with the system. Any of you who have watched these sorters work realize they are as fascinating as any toy you can find. We have been very fortunate in that when we bought this system we also went out and got ourselves a very good electronics fellow and he and our very qualified electrician have been able to handle all the problems that can arise. Our downtime with that sorter from the day we installed it in 1974 has been very little. We take good care of it and it takes good care of us.

In 1977 Harvey came out with a detachable sling system and this eliminated two men. We do not have the detachable sling system in our sawmill. When we put the sling sorter in we were making 90,000 feet a shift and were using 16 men on the green chain for this 90,000. Today we are up over the 300,000 mark and we have five men handling the whole thing including the stacking and stickering. In addition, the stickering is a lot better with mechanical stickers and the downfall and downgrade from the kilns is far less, as most of you know. The newer sorter computers, of course, are even better than those we have. They have cassette programming tapes and power back-ups in case the mill's power supply cuts off for a few hours a day.

To continue with our sorter system, we came upon a bottleneck our trimmer system. We had a Harvey

trimmer, one of these multiple saw trimmers, and we could not really trim over about 250,000 feet a shit with that trimmer. We realized even doing this much that we were losing a fair amount of lumber. As all you fellows who own sawmills know, those trimmer men are almost as bad as saw filers. They get too many boards coming at once, they get mad and just punch that red button and everything goes down the drain.

We were out west once and saw this new trimmer in a mill in Prince George. It was a three-saw trimmer, but I never could figure out what that third saw was for. We came back and ordered the same but with only two saws. We installed it and bought a hydraulic motor to run both the trimmer and the lumber sorter in conjunction with each other. We can speed up or slow down the whole system. Now that system will trim and sort up to 30,000 pieces in an eight hour shift. It was with great joy that we also found that our recovery rose unbelievably between nine and ten per cent with the use of that multiple saw trimmer. The whole cost of the first sling sorter that we put in was $500,000. I think we paid for it in 12 months.

We then got them to make us an electronic log sorter, but it did itself out of a job because it did such a good job. It was only built for 300 cords a day. After about two weeks in use, the logs going into the sawmill were so good that our production went up 40 per cent and we could not keep up with the log sorter so we had to abandon it. That was because the log sorter was a lineal one. We have been working on a cross hall log sorter that will do up to 1,200 cords in an eight hour shift.

We just purchased a new sling sorter for our planing mill which is going to be a combination sling sorter and tray sorter. If your main product, for example, is 16 foot two by four, one tray will carry jack pine and one will carry spruce. We have to sort because we treat. The main flow of the lumber will go on those two trays and the rest, the trim backs and downgrades, will go up into the slings which will not have to be lowered very often, and therefore will not cut down on production. We are doing 225,000 feet a day in our planing mill now, that is our average, and we hope that when the installation is complete by the end of February we will be up to around 300,000 feet a shift.

We also use electronics for something else that we think may be one of the most important uses that it has: the gathering of information and monitoring of our whole production facility. The information comes to our office from both the sawmill and the planing mill. There are computer read-outs in the mills and in our office. It rolls over every minute with the new figures. We have the production, the production sizes and the percentages, etc. right in front of us on a screen at all times during the day. We firmly believe that electronically-gathered information is, and will be more and more, management's greatest working tool. It will be the difference between success and failure, the difference between profit and loss.

* * *

Management and Process Control Systems

Ed Rickford
North American Controls Inc.

Today we have a productive capacity in North America to probably build over three million homes a year. Many experts predict one and a half million homes a year for the whole of North America over the next 10 years. If that is the case, only those mills that have a competitive edge stand any chance for survival in the years ahead.

Many speakers have covered the subject of acquiring this competitive edge by implementing the techniques of:

- Scant sawing
- Reducing saw kerf without losses in production rates
- Optimizing product mix for either highest recovery in terms of LRF, highest dollar yield, or maximum contribution to profit

It is no longer possible today to buy a forest and liquidate it quickly into a profit. Therefore, sawmilling today is an art. There are three major requirements we have to fulfill in order to excel at the practice of this art:

- You must understand the underlying theory.
- You must practice the art in order to become a master of it.
- Most importantly, there must be a total commitment from management right down to the operating level in order to truly master the art that sawmilling has become.

Today the technology exists to scan incoming stems from the forest (Figure 1) very precisely to:

- Determine its geometry
- Utilize optimization techniques based on Best Opening Face sawing solution programs to optimally buck stems into short log segments entering the sawmill.
- Generate stem tally reports.

Those mills that have log sort capability can automatically sort logs to various bins, not only by log size classes, but preferably by set classes corresponding to log breakdown machines. The capability also exists to re-scan all of the logs that come into the mill using the same type of best opening face optimization techniques to automate the setworks positioning of the headrig log breakdown machines.

You have also heard about lumber profile scanners that define the wane geometry of boards for use in edging and trimming optimization systems and the automatic sorting of lumber. Actual log and lumber measurement data are fed into the mill's management information system for direct comparison with the theoretical lumber output which should have been produced from the log mix processed.

The measure of the mill's operating efficiency is the ratio of the actual LRF to the theoretical LRF. Yours is a perfect operation when that ratio is equal to one. However, the measure of your efficiency is determined by how close you approach one under different operating conditions. Even more importantly, management is provided a decision tool for correcting efficiency problems on a timely basis.

Figure 2 represents a typical example of merchandizing a tree length stem to its best end use. The standing tree, particularly on the West Coast, cannot be hauled on most highways tree length to the mill, and invariably requires a woods bucking cut to reduce the tree to a butt stem and a top stem.

The woods bucking cut is one of the most important financial decisions and it is probably the most unscientifically made cut of all. Ideal merchandizing

successively until light is blocked by the physical presence of a log in the scanning field of view. The computer counts the number of blocked elements and determines the log's diameter to an accuracy of 0.1 inch.

This optical calipering technique between parallel light lines on 0.1 inch centers is so fast that a scan is taken approximately every 0.5 inches along the length of the log travelling at about 350 linear feet per minute. Scanning accuracy remain the same anywhere within the scanning field of view, even if there is log bounce within the vertical and horizontal planes.

NAC light calipering scanners mounted on two or more axes can be used to detect sweep and crook, provided logs are conveyed through the scanner without wobbling from side to side. One of the parallel light lines is considered a '0' Reference Line, from which the computer counts the number of elements to the outer and inner edges of the log, and by subtraction deduces the diameter and sweep as illustrated in Figure 7.

Light emitting diode technology was selected for the NAC scanner because of its recognized high reliability and long life in typical consumer products such as calculators, wrist watches, and so on, with a usable life of 10 or more years. Laser scanners, on the other hand, have a usable life of about 1.5 to 2.5 years.

The theory already exists to include sweep in the algorithms for optimized bucking and log breakdown but its implementation in sawmills will have to wait until engineers design conveyors that inhibit log movement as they are transported through the scanner. Box chain is not an ideal log conveying medium to minimize wobble.

The scanner's internal electronics, which although comprised of an abundance of components, still requires relatively little maintenance. A scanner system installed for the Weyerhaeuser Company in Cottage Grove, Oregon, since 1973 has required virtually no maintenance from NAC over the last 10 years.

Sorter memories are now developed to the point where they can truly be described as 'standard' products, requiring little or no field service support for installation.

Weldwood of Canada at Houston, B.C. has four log bucking lines provided with scanners and length measuring systems for tree length stems up to 85 feet. Adequate distance was provided in the original design for scanning the entire stem before computing the optimum bucking solution.

A single computer controls all four bucking lines and displays to each operator the optimum bucking sequence for implementation. After bucking, logs are automatically routed by size corresponding to one of three decks servicing three Chip-N-Saws.

Optical limit switches are used to measure gross stem length and they are used in conjunction with a shaft encoder which is directly coupled to the head shaft of the conveyor and is used to correct for log slippage and to refine length measurement to plus or minus one inch.

A dual bucking line was installed at the former Crown-Zellerbach sawmill in Elk Falls, B.C., a design concept which I believe was borrowed from the Weyerhaeuser small log mill in Cottage Grove, Oregon. In a relatively cramped area CZ was able to install an infeed conveyor feeding stem full length through a NAC scanner.

Stems are automatically routed to one of two conveyors feeding the cut-off saws by monitoring the trailing ends of the preceding stem to determine conveyor availability and loading stems in a rythmic see-saw fashion with a minimum gap. One operator should be able to control both of these bucking lines, processing up to 2,500 stems per shift.

Figure 8 illustrates the information displayed to the bucking operator. Stem length is displayed to the nearest one inch and butt and top diameter to the nearest tenth of an inch. The computer only displays the optimum bucking solution, which will maximize the value of lumber products from the entire stem after testing all of the permutations and combinations for that stem length.

In this case, an 18 foot plus 16 foot plus 14 foot plus bucking solution with 22 inches of trim loss was generated as optimum for the 51 foot one inch stem, having a butt diameter of 13.9 inches and a top diameter of 7.1 inches.

Other than displaying log production rates and the status of the system's photocells, the remainder of the video display is not cluttered up with data that an operator cannot get to grips with at high production rates, but is available to display diagnostic messages in the event of a system malfunction.

NAC scanners can be mounted on a half taper Chip-N-Saw or a full taper Chip-N-Saw. Depending on rate of taper, there is a general rule which says that logs from four to nine inches have a higher LRF broken down under a half taper asymmetric sawing method, whereas logs 12 inches in diameter and up have a higher recovery factor under a full taper asymmetric breakdown method. Logs in the nine inch to 12 inch diameter class represent a transition zone in

of the tree illustrated in Figure 2 would be as follows in a multi-processing complex:

- Butt log to a band headrig carriage for maximum grade recovery.
- The middle section of the stem approximates a cylinder and would be merchandized to a plywood plant.
- The smaller, more rapidly tapered top log would be bucked for breakdown into random length dimension lumber at a canter/twin or quad headrig Chip-N-Saw. The very small top logs would be merchandized into studs, possibly at a quad band.
- The residual top end would, of course, be converted into chips.

That is the best generalized concept of merchandizing a tree length stem to its best end use.

The basis of all this is the optimization technique known as best opening face (BOF). BOF is the acronym used to define what combination of products will return the highest value from each individual log to be processed.

Figure 3 depicts an optimum BOF solution on a log 20.4 inches at the small end, 16 feet long and tapering at the rate of two inches in 16 feet. The theoretical BOF solution calls for a 12-inch cant, a one-inch sideboard, and a two-inch sideboard on the left side of the cant and two two-inch sideboards, and a one-inch sideboard on the right side of the cant, indicating an asymmetric solution, requiring a headrig capable of offsetting the geometric centerline of the log from the centerline of the machine.

Let us assume that you want to build a new sawmill and you are planning to spend maybe $30-35 million. You hire consulting engineers, study the feasibility of the project in detail, and determine that the profitability looks good based on theoretical programs like BOF. You build the mill and then you turn over machine control to a third grade operator who is expected to implement this theory that has provided the justification for the investment.

The problem facing an operator is illustrated in Figure 4 on a log measuring 13.4 inches at the small end, tapering at the rate of two inches in 16 feet for eight feet to 20 feet in two inch increments. The first problem that confronts the operator is what cant size to select for that particular log. Even if the operator is given credit for being able to eyeball the diameter, the rate of taper, and the length of that log all to within accuracies of 0.1 inches, he cannot be credited with determining that a four inch center cant will generate a value of $47.45; or that an eight inch cant would yield a value of $44.78; a 10 inch cant $43.04; and a 12 inch cant $51.01. The spread between the worst decision and the best decision is about $8.

High production mills today, particularly here in Canada, can process up to 10,000 short logs every eight hours. Can a misjudgement costing up to $8 on one log be afforded?

As Figure 4 illustrates, the next log has a 13.6 inch small end diameter, or an increase of only 0.2 inches over the preceding log. It is doubtful whether an operator can eyeball that small a change in diameter at today's production rates. The optimum solution for a 13.6 inch log has increased the value of products to $53.87, or an additional $4.

The chances are, particularly with chipping headrig machines, that the succeeding log 13.6 inches in diameter would have the identical set as the preceding 13.4 inch log, and another $4 potential increase in yield would disappear in the form of chips at source. That is the problem facing the headrig operator.

Consider the problem facing the bucking operator. Incidentally, these are real numbers out of a U.S. mill. Figure 5 illustrates alternative bucking sequences on a stem 44 feet two inches in length, with a butt diameter of 11.5 inches and a top diameter of six inches. The computer selected an optimum bucking sequence for that stem of 16 feet plus 16 feet plus 10 feet, yielding a value of $31.25.

To derive this optimum solution, the computer examined about 156 different ways in which to buck that stem. If the operator had taken a first cut of 20 feet (as is fairly standard practice in the south with straight stems) he would have been forced to take a 20 foot top cut, leaving a four foot loss to chips and a total stem value of $27.45, or an approximate loss in dollar yield of $4.

The physical requirements of a typical lineal bucking system should provide the ability for scanning the entire length of stem before making any bucking decisions (Figure 6). Even today, most consulting engineers design bucking lines with the log deck about three or four feet from the cut-off saw, and then request a bid for a bucking optimization system after the facility is embeded in concrete.

The heart of any system is, of course, the scanner which must define precisely the geometry of the stem or bucked log. The NAC scanner comprises light emitting diodes (LED's) and corresponding photo diodes, both on 0.1 inch centers. Each LED is turned on individually for 50 ns and if its IR (infra-red) light is seen by its corresponding photo-diode, or eye, it is turned off and the next LED is turned on, and so on

which half taper and full taper intersperse inexplicably.

Figure 9 illustrates the kind of video display presented to an operator in a multiple headrig mill. Each operator sees the production level of his colleagues, and experience has shown that this inter-operator challenge has the effect of increasing productive capacity by up to 15 per cent.

Another scanning technique involves a transverse scanner to scan individual stems travelling lateral up to a lugged inclined Jackladder (Figure 10).

One scanner comprises transmitter and receiver elements mounted on one foot or two foot centers along a scaffold spanning the entire conveying assembly. A vernier transmitter/receiver section refines stem length measurement to within three inches.

Another system is capable of processing tree length stems at up to 12 stems per minute. This is probably the only system which has been installed in a log merchandizer as a truly dual redundant system. Every component has a backup which monitors the primary device and in the event of a data disparity, the system will alarm the operator by audible alarms and printed reports, and the back system unit takes on the operation until repairs can be effected.

There is no manual mode function in this system which is designed to merchandize tree length stems optimally for best end use to the sawmill, plywood plant, and residual tops to chips.

The NAC transverse scanner is also used in carriage scanning applications when log geometry and taper rate are previously calculated to facilitate independent knee positioning to the BOF.

NAC's dual process electronics cabinet generally has one processor and I/O rack dedicated to machine setworks control, and the other processor/IO rack acts as a supervisor running BOF programs offline and serving as an active spares package. The CPU/IO racks are mounted on a swing-out door providing easy access to them and to the power supply back panel. This design permits location of the cabinet against a wall, thereby conserving space in the computer room. To guard against infancy failures of electronic components, complete systems are tested for several weeks in a temperature controllable chamber where the temperature is oscilated from -40°C to 40°C.

Examples of management reports available from scanning and control systems are shown in Figures 11 to 14.

Finally, the management report of primary interest to mill management for monitoring operating efficiency against annual goals is shown in Figure 15. Shift data on stem input, bucked sawlogs into the mill, and projected lumber output is extrapolated over one year's operating shifts.

The difference between projected log cost and lumber sales realization represents the operating margin. At the end of each shift management can readily see if performance on that day, repeated over a one year operating schedule, would meet targeted profit goals.

Figure 16 illustrates the economic significance of high precision positioning setworks systems which is a first requirement in being able to reduce rough green target sizes.

In a typical mill processing 41,000 linear feet per shift through a C-N-S, the ability to reduce target size by 0.080 inches from 1.780 inches to 1.700 inches would realize $949.00 additional sales realization per year. Superimposing an optimized log bucking system in this mill would increase the operating margin by an addiitional $900,000.

At this point, I can only exhort all of you who are managers and operators to practice the art of sawmilling with all the technology available in order to master it and survive in the hard times ahead of us all.

* * *

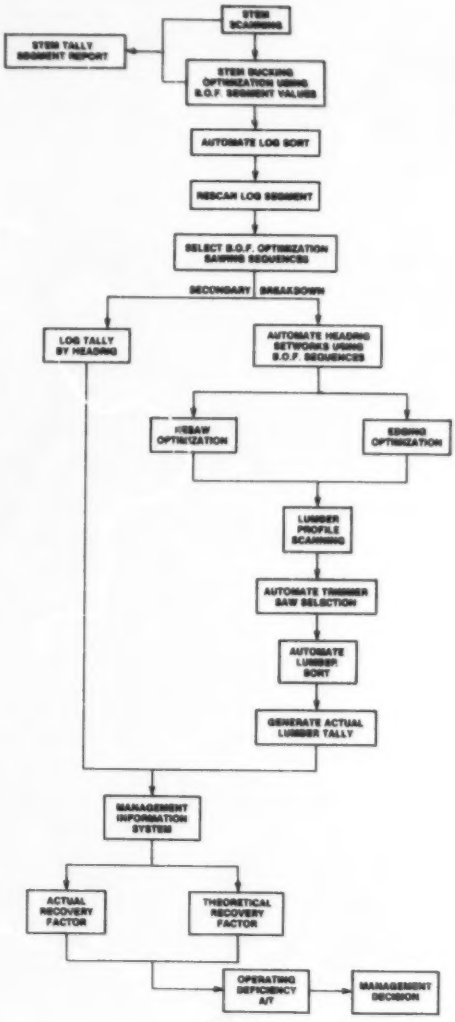


FIGURE 1

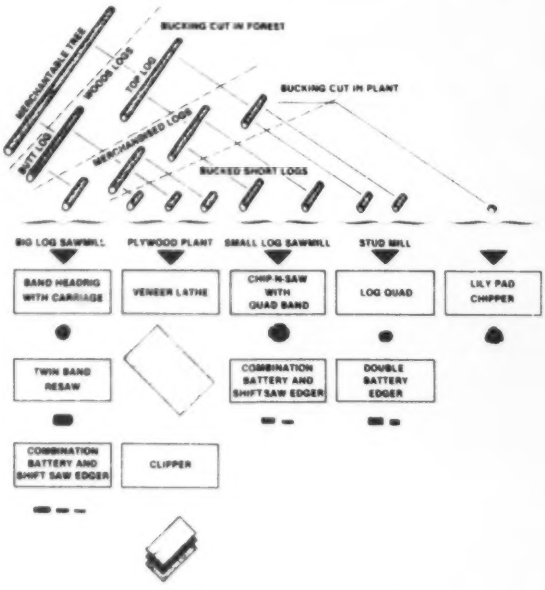
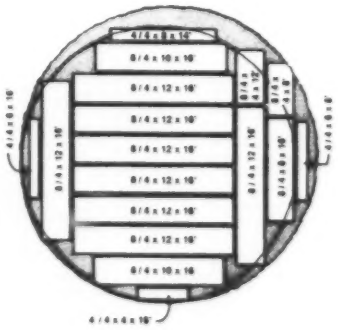


FIGURE 2

LOG DIAMETER (IN)	LOG LENGTH (FEET)	BEST OPENING FACE DISTANCE FROM CENTER LEFT (IN)	BEST OPENING FACE DISTANCE FROM CENTER RIGHT (IN)	BEST OPENING FACE DISTANCE FROM CENTER RANGE	DISTANCE LEFT FACE TO CANT (IN)	NOMINAL CANT SIZE (IN)	CANT OPENING FACE DISTANCE FROM CENTER LEFT (IN)	CANT OPENING FACE DISTANCE FROM CENTER RIGHT (IN)	CANT OPENING FACE DISTANCE FROM CENTER RANGE	LUMBER RECOVERY FACTOR	LUMBER TALLY (BD. FT)
20.4	16	9.917	10.784	1 FT	3.280	12	10.100	9.910	1 FT	9.43	371

SAWING SEQUENCE
LOG 1 2 12 2 2 1
CANT 1 2 2 2 2 2 2 2 2 2 1

OFFSET 0.000 IN FENCE 0.130 IN.



BOARD FT	FLITCH / CANT / FLITCH SEQUENCE
6	4/4 x 6 x 16
32	8/4 x 12 x 16
260	4/4 x 4 x 16 8/4 x 10 x 16 8/4 x 12 x 16 8/4 x 12 x 16 8/4 x 12 x 16 8/4 x 12 x 16 8/4 x 10 x 16 4/4 x 8 x 16
40	8/4 x 12 x 16 8/4 x 6 x 12
37	8/4 x 8 x 16 8/4 x 4 x 8
4	4/4 x 6 x 8

FIGURE 3

Figure 4

BOF Summary

Taper - 2 inches per 16 feet

12.4 in.	8 ft.	10 ft.	12 ft.	14 ft.	16 ft	18 ft.	20 ft.
Log Seq	2(2)- 4-2(2).1	2(2)- 4-3(2)	2(2)- 4-3(2)	2(2)- 4-3(2)	2(2)- 4-3(2)	2(2)- 4-3(2)	2(2)- 4-3(2)
Cont Seq	7(2)	7(2)	7(2)	7(2)	7(2)	7(2)+1	7(2)+1
BF LBF	92 10.90	113 10.57	137 10.48	162 10.37	186 10.23	212 10.17	239 10.16
BED OFF	0.30 0.70	0.30 0.80	0.30 0.70	0.30 0.70	0.30 0.70	0.30 0.70	0.30 0.70
$Value	$ 19.09	$ 25.78	$ 34.04	$ 39.08	$ 47.45	$ 51.84	$ 61.62
Log Seq	1.1(2)- 4-2(2)	1.1(2)- 4-2(2)	2(2)- 6-2(2)	2(2)- 6-2(2)	2(2)- 6-2(2)	2(2)- 6-2(2)	2(2)- 6-2(2)
Cont Seq	7(2)	7(2)	7(2)	7(2)	7(2)	7(2)+1	7(2)+1
BF LBF	89 10.62	113 10.51	138 10.50	163 10.39	187 10.32	211 10.09	241 10.19
BED OFF	0.20 0.30	0.40 0.20	0.40 0.00	0.40 0.00	0.40 0.00	0.40 0.20	0.40 0.00
$Value	$ 19.83	$ 25.05	$ 35.16	$ 40.68	$ 48.76	$ 51.31	$ 64.42
Log Seq	2- 8-2	2- 8-2	2- 8-2	1(2)- 8-2(2)	1(2)- 8-2(2)	1(2)- 8-2(2)	1(2)- 8-2(2)
Cont Seq	7(2)	7(2)	7(2)	7(2)	7(2)	7(2)+1	7(2)+1
BF LBF	88 10.42	111 10.39	134 10.20	159 10.14	182 10.01	211 10.14	235 9.99
BED OFF	0.20 0.00	0.40 0.00	0.40 0.00	0.40 0.90	0.40 0.80	0.40 0.80	0.40 0.80
$Value	$ 20.03	$ 25.55	$ 35.32	$ 38.19	$ 44.78	$ 49.53	$ 62.16
Log Seq	-10-2	-10-2	-10-2	2-10-21	2-10-2	2-10-2	2-10-2
Cont Seq	7(2)	7(2)	7(2)	7(2)	7(2)	7(2)+1	7(2)
BF LBF	85 10.15	108 10.05	130 9.89	156 9.99	181 9.92	211 10.09	228 9.67
BED OFF	0.20 0.90	0.40 0.90	0.40 0.90	0.40 0.10	0.40 0.20	0.40 0.20	0.80 0.50
$Value	$ 18.02	$ 23.04	$ 32.46	$37.25	$43.04	$ 47.49	$ 59.46
Log Seq	-12-	-12-	-12-	-12-1	-12-1	1-12-1	1-12-1
Cont Seq	7(2)	7(2)	7(2)	7(2)	7(2)	7(2)	7(2)
BF LBF	88 10.42	111 10.39	134 10.20	159 10.22	183 10.10	201 9.68	228 9.67
BED OFF	0.20 0.10	0.40 0.10	0.40 0.10	0.40 0.20	0.40 0.30	0.30 0.00	1.30 0.00
$Value	$ 20.68	$ 29.16	$ 38.08	$ 41.34	$ 51.01	$ 59.43	$ 70.90

13.6 in.	8 ft.	10 ft.	12 ft.	14 ft.	16 ft	18 ft.	20 ft.
Log Seq	2(2)- 4-2(2).1	2(2(- 4-3(2)	2(2)- 4-3(2)	2(2)- 4-3(2)	1.2(2)- 4-3(2)	1.2(2)- 4-2(2).1	1.2(2)- 4-3(2)
Cont Seq	7(2)	7(2)	7(2)	7(2)+1	7(2)+1	7(2)+1	8(2)
BF LBF	92 10.59	114 10.49	140 10.36	164 10.21	189 10.08	219 10.20	243 10.04
BED OFF	0.40 0.40	0.40 0.90	0.40 0.80	0.40 0.90	0.20 0.40	0.20 0.10	0.20 0.10
$Value	$ 19.41	$ 216.62	$ 34.88	$ 39.99	$ 48.71	$ 53.35	$ 64.61
Log Seq	2(2)- 6-2(2)	2(2)- 6-2(2)	2(2)- 6-2(2)	2(2)- 6-2(2)	2(2)- 6-2(2)	2(2)- 6-2(2)	2(2)- 6-2(2)
Cont Seq	7(2)	7(2)	7(2)	7(2)+1	7(2)+1	7(2)+1	7(2)+1
BF LBF	93 10.78	117 10.52	42 10.53	167 10.36	196 10.49	209 9.79	248 10.21
BED OFF	0.40 0.00	0.40 0.10	0.40 0.10	0.40 0.10	0.40 0.10	0.40 0.40	0.40 0.20
$Value	$ 20.08	$ 26.28	$ 36.44	$ 41.89	$ 50.02	$ 52.31	$ 66.52
Log Seq	2- 9-2	1(2)- 8-1(2).1	1(2)- 8-2(2)	1(2)- 8-2(2)	1(2)- 8-2(2)	1(2)- 8-2(2)	1(2)- 8-2(2)
Cont Seq	7(2)	7(2)	7(2)	7(2)+1	7(2)+1	7(2)+1	7(2)+1
BF LBF	91 10.40	116 10.49	140 10.36	165 10.23	192 10.28	218 10.19	224 10.04
BED OFF	0.40 0.10	0.40 0.20	0.40 0.90	0.40 0.80	0.40 0.90	0.40 0.80	0.40 9.90
$Value	$ 20.87	$ 25.99	$ 36.30	$ 39.84	$ 46.49	$ 50.67	$ 64.71
Log Seq	-10-2	-10-2	-10-2	2-10-2	2-10-2	2-10-2	2-10-2
Cont Seq	7(2)	7(2)	7(2)	7(2)+1	7(2)+1	7(2)	7(2)+1
BF LBF	88 10.13	110 9.95	136 10.06	162 10.09	188 10.06	214 9.99	240 9.91
BED OFF	0.40 0.80	0.40 0.80	0.90 0.80	0.40 0.20	0.40 0.10	0.80 0.00	0.80 0.10
$Value	$ 18.84	$ 13.48	$ 33.48	$ 39.00	$ 44.67	$ 49.24	$ 61.75
Log Seq	-12-	-12-	-12-	-12-	1-12-1	1-12-1	1-12-1
Cont Seq	7(2)	6(2)+1	6(2)+1	7(2)	7(2)+1	7(2)	7(2)
BF LBF	91 10.40	111 9.98	133 9.84	159 9.87	188 10.04	213 9.98	235 9.73
BED OFF	0.40 0.20	1.30 0.00	1.30 0.00	1.20 0.00	1.20 0.00	1.20 0.00	1.20 0.00
$Value	$ 21.52	$ 29.26	$ 39.21	$ 42.41	$ 53.87	$ 62.15	$ 74.03

Figure 5

Comparison of Bucking Sequences

	Lead		Trail		Length		Taper		Correl		Av Dev		Cubic		Brd Ft		LRF		Value		Solution	
	11.5		6.0		44' 2"		0.303		0.74		0.34		18.32		128		7.00		31.25		16 16 10	
M	13.4	13.0	12.1	11.6	11.5	11.2	11.1	11.1	11.0	11.0	11.0	10.9	10.8	10.8	10.7	10.5	10.3	10.3	10.2	10.2		
S	14.5	15.0	13.6	12.6	12.9	12.3	11.3	11.0	11.1	11.3	11.4	11.7	11.9	12.0	12.0	12.2	12.1	12.2	13.0	12.3		
M	10.2	10.1	10.0	10.0	10.0	9.9	9.9	9.7	9.6	9.5	9.5	9.1	9.0	8.8	8.6	8.6	8.6	8.5	8.4	8.4		
S	12.2	11.1	11.4	10.6	10.7	10.5	10.6	11.2	11.0	11.3	11.1	10.1	10.0	9.8	9.5	9.5	9.3	9.2	9.1	9.0		
M	8.3	8.2	8.1	8.1	8.1	8.0	7.9	7.9	7.8	7.7	7.7	7.7	7.7	7.7	7.6	7.6	7.5	7.4	7.4	7.4		
S	9.3	8.6	8.7	8.6	8.6	9.0	8.5	8.6	9.0	9.4	8.5	8.2	8.3	8.4	8.4	8.9	9.5	8.1	8.1	8.1		
M	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.1	7.1	6.9	6.9	6.9	6.9	6.9	6.8	6.8	6.6	6.8	6.6	6.7	6.6	6.3
S	8.6	8.1	8.1	7.9	7.6	7.9	8.1	7.7	7.7	7.5	7.6	7.6	8.1	8.2	7.3	7.7	7.7	8.2	7.0	6.8		
M	6.2	6.1	6.1	6.0	6.0	6.0	5.9	5.8														
S	6.9	7.4	6.6	6.4	6.5	6.5	6.5															
	1 1x4x12		4 2x4x10		2 2x4x16		1 2x6x12		4 2x6x16													

Lead	Trail	Length	Taper	Correl	Av Dev	Cubic	Brd Ft	LRF	Value	Solution
11.5	6.0	44' 2"	0.303	0.74	0.34	18.32	119	6.51	27.45	20 20 *
1 1x4x12	1 1x4x18	2 2x4x10	3 2x4x20	1 2x6x16	2 2x6x20					
11.5	6.0	44' 2"	0.303	0.74	0.34	18.32	127	6.91	29.81	20 14 8 *
1 1x4x12	2 2x4x 6	2 2x4x10	1 2x4x12	1 2x4x14	1 2x4x20	1 2x6x12	1 2x6x16			
2 2x6x20										
11.5	6.0	44' 2"	0.303	0.74	0.34	18.32	126	6.99	30.20	20 12 10*
1 1x4x12	4 2x4x10	2 2x4x12	1 2x4x20	1 2x6x12	1 2x6x16	2 2x6x20				
KIE										
11.5	6.0	44' 2"	0.303	0.74	0.34	16.32	126	6.88	28.31	18 16 8 *
1 1x4x12	2 2x4x 6	2 2x4x10	1 2x4x14	1 2x4x16	1 2x4x18	1 2x6x14	1 2x6x16			
11.5	6.0	44' 2"	0.303	0.74	0.34	18.32	127	6.95	28.31	18 16 8 *
1 1x4x12	4 2x4x10	2 2x4x14	1 21x4x18	1 2x6x16	1 2x6x16	2 2x6x18				
11.5	6.0	44' 2"	0.303	0.74	0.34	18.32	128	6.99	29.33	18 12 12*
1 1x4x 8	1 1x4x12	2 2x4x10	4 2x4x12	1 2x4x18	1 2x6x12	1 2x6x16	2 2x6x18			
KIE										
11.5	6.0	44' 2"	0.303	0.74	0.34	18.32	127	6.92	30.83	16 18 8 *
1 1x4x12	2 2x4x 6	2 2x4x10	1 2x4x16	1 2x4x18	1 2x6x12	4 2x6x16				

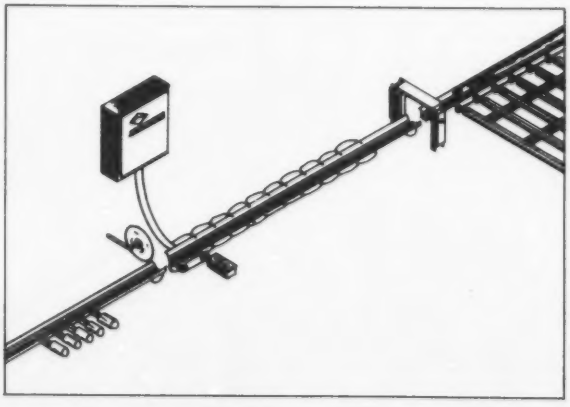


FIGURE 6

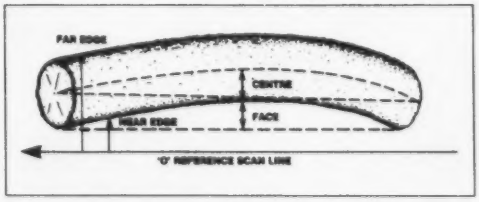


FIGURE 7

Figure 8

Bucking Operating Video Display

Stems	333	299	305*	327
Blocks	894	812	849	886
Stop	**********	* ***		
Scan 12.5	Speed 2.2			
Clear Infeed At Lunchtime				
Diameter	Length	Fit		
13.9	7.1	51'	1"	Good
Trim	22 SOL	18	16	14

Figure 9

03:24 p.m.

	Logs			
CNS 1	2268	Cant	Pcs	Bed
CNS 2*	2009	6	4	6
Jumbo	1762			
Mk:		Dia:		0.0
Small	**Large**	**Length**		**T / C**
4.3	5.3	16' 5"		1
9.5	12.5	17' 3"		3
8.1	9.8	20'5"		2

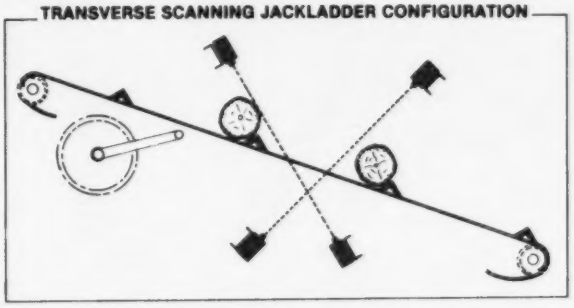


FIGURE 10

Figure 11

Stem Tally Report of Pieces and Cubic Volume
by Length Classes With a Graphical Histogram to
Readily Identify Major Trends

Log Bucking
Log Tallies

07/01/83 13:24:07

Last Cleared: 07/01/83 11:37:17
Steam Tally by Length Classes

	Pieces	% by Pcs	Cubic Ft	% by CFT	
Short	13	1.3	169	0.9	X
22'	16	1.6	155	0.8	X
24'	18	1.8	208	1.1	X
26'	25	255	1.4		X
28'	65	6.4	745	4.0	XXXX
30'	60	5.9	739	4.0	XXXX
32'	63	6.2	869	4.7	XXXXX
34'	69	6.8	1049	5.7	XXXXXX
36'	85	8.4	1311	7.1	XXXXXXX
38'	67	6.6	1071	5.8	XXXXXX
40'	62	6.1	1099	6.0	XXXXXX
42'	91	8.9	1660	9.0	XXXXXXXXX
44'	72	7.1	1332	7.2	XXXXXXX
46'	92	9.0	1970	10.7	XXXXXXXXXXX
48'	55	5.4	1198	6.5	XXXXXXX
50'	56	5.5	1379	7.5	XXXXXXXX
52'	29	2.9	780	4.2	XXXX
54'	21	2.1	603	3.3	XXX
56'	26	2.6	790	4.3	XXXX
58'	13	1.3	415	2.3	XX
60'	13	1.3	419	2.3	XX
62'	6	0.6	197	1.1	X
Total	1017		18411		

Figure 12

Stem Tally Report by DBH Classes - Useful Data for Confirmation of Forest Inventory Surveys

Stem Tally by DBH Classes

	Pieces	% by Pcs	Cubic Ft	% by CFT	
6"	5	0.5	29	0.2	
7"	32	3.1	233	1.3	X
8"	126	12.4	1275	6.9	XXXXXXX
9"	212	20.8	2745	14.9	XXXXXXXXXXXXXX
10"	231	22.7	3851	20.9	XXXXXXXXXXXXXXXXXXXX
11"	183	18.0	3667	19.9	XXXXXXXXXXXXXXXXXX
12"	107	10.5	2636	14.3	XXXXXXXXXXXXX
13"	71	7.0	2098	11.4	XXXXXXXXXX
14"	29	2.9	1017	5.5	XXXXX
15"	13	1.3	530	2.9	XXX
16"	5	0.5	221	1.2	X
17"	1	0.1	48	0.3	
18"	2	0.2	60	0.3	
Total	1017		18411		

Figure 13

Sawlog Tally by Length Classes

	Pieces	% by Pcs	Cubic Ft	-% by CFT	
8'	75	2.9	136	0.7	X
10'	74	2.8	188	1.0	X
12'	679	25.9	4088	22.5	XXXXXXXXXXXXXXXXXXXXXXX
14'	273	10.4	1507	8.3	XXXXXXXX
16'	708	27.0	4573	25.1	XXXXXXXXXXXXXXXXXXXXXXXX
18'	158	6.0	939	5.2	XXXXX
20'	652	24.9	6765	37.2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Total	2619		18196		

Figure 14

Downtime Report by Reason, Generated on a Pushbutton Panel by the Operation

System Usage Analysis

	Percent of Total	
System Usage	76.7	4 hr 30 min
System Idle:		
Reason Unspecified	23.3	1 hr 22 min
Debarker Down	0.0	0 min
Electrical	0.0	0 min
Mechanical	0.0	0 min
Transfer Deck is Full	0.0	0 min

Figure 15

Management Report

	Units	Per Shift	Per Year	Value
Stem Input				
Avg. Stem Length	ft.	47.9'		
Avg DBH	in.	9.6"		
Stems Process	Nos.	1324	522,600	
Stem Volume - $58.50/cord	cords	318	127,688	
Stem Volume - $80/Cu.Ft.	Cu.Ft.	23,293	9,317,188	$7,469,760
Trim Volume	Cu.Ft.	638	255,200	
% Trim Loss	%	2.7%		
Bucked Logs to Mill				
Avg. Small End Diameter	in.	7.0"		
Avg. Bucked Log Length	ft.	18.1'		
No. of Logs 8' - 20'	Nos.	3818	1,527,200	
Lineal Feet Process	Lin.Ft.	81,404		
Avg. Log Processing Rate	Ft./Min.	115		
Log Volume - Doyle	B.F.	49,437	19,774,800	
Lob Cubic Volume	Cu.Ft.	22,655	9 062,000	
Lumber Output				
No. of Pieces Produced	Pcs.	13,020		
Pieces Processed per Minute	Pcs/Min.	24.5		
Product Mix:				
1x4 - 2.2% - $150/MBF	B.F.	3,404	1,361,600	222,744
2x4 - 40.4% - $259/MBF	B.F.	63,072	25,228,800	6,054,912
2x6 - 57.4% - $265/MBF	B.F.	89,779	35,911,600	9,696,132
Green Lumber Output	B.F.	158,255	62,502,000	$16,258,860
Falldown Adjustment - 15%		23,438	9,375,200	$2,438,803
Dry Finished Lumber - $260/MBF		132,817	53,126,800	$13,520,057
Operating Margin				
Lumber Recovery Factor	B.C./Cu.Ft.	6.8		
Cords Per MBF		2.03		

Readjustment of the operation to satisfy target goals can thus be undertaken in a timely manner.

Figure 16

	Manual Bucking			Optimized Bucking		
	1.780"	1.750"	1.700"	1.750"	1.750"	1.700"
StemsShift	945	945	945	898	898	900
Sawlogs to C-N-S	2,600	2,600	2,600	2,754	2,736	2,714
Lin.Ft.	40,898	40,872	40,898	40,898	40,872	40,898
Stem Cu.Ft. per Year	11,554,000	11,554,000	11,554,000	10,980,512	10,975,181	11,000,051
Lost Cost per Year	$13,443,870	$13,443,870	$13,443,870	$12,737,394	$12,731,210	$12,760,059
B.F. Lumber/Year	807,680,700	82,104,750	84,180,460	81,318,943	82,306,834	85,388,886
Lumber Value/Year	$19,540,393	$20,044,289	$20,489,169	$19,921,565	$20,231,856	$20,904,181
Operating Margin	$6,386,423	$6,891,728	$7,335,199	$7,284,028	$8,610,189	$6,234,672
Variances Due to:						
Scant Lumber Sizes	-	$505,325	$948,798	-	$326,161	$950,544
Optimized Bucking	-	-	-	$897,605	$718,481	$899,473
-Optimizing Bucking	-	$505,325	$948,796	$897,605	$1,223,766	$1,848,249

State of the Art Edger and Trimmer Optimizers

L. Grove
Grove Machinery Co.

Before I get into a detailed discussion of edger and trimmer control systems and their payback potential, it is important to restate the urgent need to improve productivity in our sawmills. Manufacturing costs have been rising steadily. The easy answer in the past has been to pass on increased manufacturing costs by raising prices. This is not possible now due to market conditions. Trying to survive while waiting for lumber prices to improve has been painful and costly. The recent depression in our industry has forced us to search in many directions for relief.

To date, the main efforts to reduce manufacturing costs have been to reduce manpower. The standard justification for capital expenditure has been based on how many men could be eliminated. Another method to reduce manufacturing costs has been to increase production by installing faster machinery. Both reducing manpower and increasing machinery performance are valid steps we've taken to relieve rising costs and survive in our industry. However, we are now approaching a point where our men and machinery are being taxed to their limits. In many cases we are asking machine operators to be super-human.

The edger and trimmer are two places where this is most evident. We have increased piece counts dramatically, without paying enough attention to operator performance. For example, 15 pieces a minute through the edger means the operator makes 6,750 decisions in a seven and one-half hour shift. And 70 pieces a minute through the trimmer means the operator makes 31,500 decisions each shift. Many mistakes are made by both the edgerman and trimmerman at these piece rates. I think we can all agree that reducing operator mistakes would add to our profits.

The name 'optimizer' was coined to convey the idea that 'computerizing' operator decisions could eliminate costly operator mistakes. There are enough optimizer systems in operation in North America today that we can say from field experience that optimizing does reduce costly operator errors. Now I will proceed to describe edger and trimmer optimizer systems, explaining how these systems can impact your mill's profitability.

There are three basic parts to any optimizer system. The first part is the measurement or scanning system. The second part is the decision-making portion; this step takes the information from the scanners and determines the optimum solution. The third part of the system is the mechanical portion which does the positioning and feeding to carry out the decision. Relating this back to the operator, we can think of the scanners as replacing the operator's eyes, the computer decision as replacing the operator's brain, and the mechanical portion as replacing whatever physical functions the operator performs. I think the best way to provide a good overall description of optimizer systems will be to discuss each of these three parts separately. I will start with the scanning or measurement portion of the system.

Three basic techniques for scanning are presently being used. One is mechanical and the other two are optical. The mechanical system uses sets of fingers that drag along the piece as it moves through the fingers. The fingers are connected to rotary encoders. This provides a method to trace the finger's path which corresponds to a cross-section of the piece. This mechanical approach has some drawbacks and has not become popular. Initial cost is high because each cross-section requires a separate set of fingers and encoders. As piece-rates become higher, the ability of the mechanical finger to track over an uneven surface without vibration or bounce becomes more difficult. Also, mechanical moving parts require careful maintenance to retain the accuracy of the readings.

A second technique uses sets of lasers and optical detectors. A laser beam is aimed at the board at a convenient angle, such as 45 degrees. As the board moves through this laser beam, the position of the beam on the surface of the piece is measured by the detector. The laser beam traces a cross-section since its position is mathematically related to the piece thickness. The laser beam can be either a spot or a line. Spots are used for pieces travelling on cross chains, such as into the trimmer. With this arrangement, a laser and detector must be installed for each cross-section obtained. For pieces travelling longitudinally, such as feeding into an edger, a line is used. With this technique, one laser line can be used to obtain as many cross-sections as desired since the entire board passes under the laser line.

The third technique is a camera system that electronically scans the piece. This technique can be used for scanning while the piece is stationary. The cameras are mounted overhead and lighting is provided from the sides. The board is held against hook stops while the scan is taking place.

The Reticon camera technique is also being used with the piece moving under the cameras, either on cross chains or longitudinally. With Reticon camera scanning, the cameras pick up data from scan lines running the length of the board. The lines of data are then put together to form a description of the piece. This technique has the advantage of being able to collect a tremendous amount of data about the piece.

The information gathered by the camera with pieces travelling, for example, at the rate of 60 lugs per minute, is stored in the computer. A printout of this information clearly shows wane, other features such as knots and even some grain structure. We can zero in on an area and even evaluate information such as knot soundness.

This brings us to the second best part of an optimizer system decision-making. Information from the sensors is fed into the optimizing section of the computer in the form of cross-section data points. The computer then evaluates the possible board sizes that will fit the piece shape. In a borderline case where a two by six could be made rather than a two by four, an operator's decision would almost always be to make a two by four. However, with accurate scanning and positioning, the two by six can be made. The computer decides that the value of the two by six plus the value of chips from the remaining volume of $3.02 is a better decision than the value of the two by four and its larger remainder of chips. In this case, the gain is $1.31, or 77 per cent.

The true optimum solution is based on dollar value, not just volume. The computer makes these judgements with ease but they are impossible for the operator to make. For example, is a longer, narrower board worth more than a shorter, wider board? Or, is it worth more to rip into two boards versus making one wider board? In some cases, making two boards can add footage. Why? Because two boards can sometimes fit into the shape of the piece more efficiently.

For optimum decisions at the trimmer, much more data than just cross-sections comes into play. The amount of usable length must be determined. This requires very accurate information about the outline of the board. The ends especially require a more dense collection of data. Again the computer finds the optimum solution.

For the computer to make intelligent decisions, it must know several things. Here are some of the variables needing to be considered:

- Species
- Lumber assortment list
- Individual board prices
- Chip price
- Wane parameters
- Inflate/Deflate price of specific board
- Splitter charge
- Operator inputs

The information can be categorized to provide a way to transfer this data into the computer. Since rules can be completely different for different species, general species categories are established. Different species categories could be used for the same species, but contain a different set of rules for some other purpose, such as domestic or export. Then within each category, the other items are dealt with, such as lumber size, prices, wane rules for various grades and so on.

Original programming and on-line changes are made by calling up the various tables onto a CRT screen and entering information through a keyboard. A typical table would be a price matrix showing a dollar value for each board that it is possible to manufacture.

This brings us to a third part of any optimizer system. This is the mechanical portion or the hardware required to position and feed the piece according to the computer solution. Before we look at the actual systems, I want to discuss two important components that are necessary to have a successful

feed system. The first is accurate linear positioners or, in more familiar terms, accurate setworks. To gain the added yield that the computers are capable of providing, we must be able to accurately position both the material being cut and the saws and cutterheads that are doing the work. These linear positioners are hydraulic cylinders with very closely controlled strokes. They are required to provide accurate position within plus or minus three to five thousandths. These positioners are now proving themselves to be rugged and reliable enough for our sawmill environment. Without these positioners, we have not been able to take advantage of computer technology.

Another very important development that has smoothed the introduction of computers is the programmable controller in a way a computer in itself. This unit acts as the interface between the computer and the machiner center. As you know, for a computer to function especially to do very complicated optimizing routines thousands of man hours are required to create the software necessary to bring the computer to life. In earlier systems, software also had to be created to control the machine centers functions such as the setworks, timing of gates, press rolls and so on. In most installations, it is impossible to plan and predict on the drawing board all the variables that are encountered during start-up and fine-tuning of a machine center. Having to go back into computer software to fine tune and make needed changes in machine control logic makes start-up of systems very cumbersome and time-consuming. Also, these software changes can be very expensive. The programmable controller solves this problem.

The programmable controller can be programmed to do the various functions on a system very easily and without any sophisticated knowledge of computer programming. Any plant electrician who is capable of reading electrical schematics can understand and program these controllers. Changes such as adding a photocell to the system for additional position feedback, or changing the sequence of operation, or adding timing functions can all be done as easily as changing wiring schematics.

The simplest added mechanics required for optimizing can be outlined in the case of a multiple saw trimmer. Here all that is required is a fence capable of positioning the piece at the proper distance from the zero saw. Positioning the piece for feeding into an edger is much more complicated. In the case of feeding cants into a gang edger. The plate at the left of the cant is attached to a linear positioner which is setting at the proper position, to establish the correct line-up of the cant with the machine. Once the correct position is established, the overhead hold down rolls are actuated to lock the cant in place while the positioning arms retract. Next the feed chain raises slightly to lift the cant off the table and feed it into the machine. After we have gone to these great lengths to position the piece perfectly on the infeed table and the piece drifts from side to side going through the edger, all is lost.

The necessity for accurate feeding has lead to the development of what we call the chain bed type feed system. Here the bottom rolls in the infeed tables and machines are replaced by a series of sharp top chains. This insures straight feeding by providing a bed of holding points rather than just line contact at the top of each feed roll. This chain bed technique has been very successful and is also being used on manually fed machines. The quality of lumber produced through a chain bed type chipping edger is dramatically better than a roll feed machine.

Now we come to the bottom line of my discussion, the question: What contribution can these systems add to a mill's profits? The revenue produced by these systems can be evaluated as a measure of reduction in operator error. Elimination of error is translated into higher yield and higher product value. Unfortunately, evaluating an operator's true day-in/day-out performance at the edger or trimmer is impossible to do. We can evaluate his performance only under test conditions. A basic knowledge of human behavior and our actual experience tell us that when the operator knows he is being tested, he will be at his best. However, we all know that many times during the day he will be performing at levels far below his best. In most cases it is possible to show significant potential improvement, even over the operator's best performance under test conditions.

Test procedures to determine operator performance are basically very simple. It just amounts to a lot of hard work. A sample population is pulled from mill flow. I can assure you from first hand experience that the two inch green southern pine boards we are using as an example are very heavy. Maximum yield is determined by placing a clear plastic template over the pieces. The theoretical yield measured by this method is then tallied. The pieces are then put back into the mill flow and the operator's results are tallied. The operator's resulting yield is compared to the theoretical measured yield in terms of a percentage of the theoretical maximum. For edgers, test results have been as low as 65 per cent and as high as 90 per cent. Average performance has been at around the 75 per cent level. Keep in mind this is under test conditions. The edgerman's overall performance may well be five per cent or even 10 per cent lower than his test performance.

To determine the earnings potential of computerizing an edger, we can look at this typical situation (Figure 1). Using an average board containing 13 board feet and a piece rate of 13 pieces

per minute, we can realize a 6.8 million board foot increase in yield by going from the 75 per cent level that we mentioned is the industry average for edgerman yield to the 95 per cent level using the edger optimizer. I realize 13 board feet per piece is high for your northern mills, but the 13 piece per minute is low. So, I feel this example is still valid.

When working with primarily three inch, four inch and six inch widths, an operator mistake is more costly. For example a two by six instead of a two by four is a 50 per cent increase in volume. Several edger optimizers are now operating, maintaining average yields of over 95 per cent. One installation in the south, where two yield tests are performed weekly, has maintained over 99 per cent yield for the last two years. The 95 per cent used for computer performance is then conservative.

Comparing lumber price to chip price, we show a $140 difference in the value of a 1,000 feet of lumber versus the equivalent of a thousand feet of lumber turned into chips (Figure 2). The $140 times our 6.8 million feet gives us earnigns of $950,000 a year. If we take our $950,000 earnings projected over the 10 year life of the system with a 10 per cent inflation rate and take into account service and maintenance charges, taxes, investment tax credits and depreciation an edger optimizer on a typical edger will earn a total of $8 million over its 10 year life (Figure 3). Using a discount rate trial analysis method, this $8 million profit computes to an after tax return on investment of 87 per cent (Figure 4). The capital investment includes a new edger and all installation costs.

To determine the earnings potential of computerizing a trimmer, we can look at this typical situation. Given an average board size of 10 board feet and a piece rate of 36 per minute, we can see an added yield of 3,570,000 board feet of lumber by elevating recovery from the 92.5 per cent level to a 98 per cent level (Figure 5). This 92.5 per cent level for a trimmer operator was determined as a reslt of testing done at a southern yellow pine mill cutting approximately 70 million board feet per year. The two saw, two man trimmers used in your northern mills are achieving better recovery than the 92 per cent and the 10 board feet per piece is still high. Again, piece counts are much higher than 36 per minute so the example is still valid. The 98 per cent computer recovery level is being achieved by several systems in the field today.

Using our $140 differential again, the annual earning capacity is $500,300 per year (Figure 6). Looking at these earnings for the 10 year life of the system with a 10 per cent inflation rate shows a total after tax cash flow of $4.1 million (Figure 7).

Again, using our discount rate trial analysis method, this $4.1 million profit computes to an after tax ROI of 83 per cent (Figure 8).

Another way to look at the situation is to compare the total investment of $383,400 to the first year net earnings of $445,300 (Figure 9). We see this calculates to be a 10.3 month payback on our investment. In conclusion, as you can see by these typical profit potential examples, we have a considerable opportunity left to maintain profitability in the sawmill by increasing yield with the use of computers. As more of these automated machine centers are installed, mills still relying on human operator decisions will find themselves in a bigger and bigger profit squeeze, finding it difficult to stay in business.

* * *

Management Information: The Benefits of Microelectronic Based Systems

Barry Gouldsborough
Spruce Falls Power & Paper Co. Ltd.

In late 1979 Spruce Falls Power and Paper Company installed an ASI Model 1052, 16K, dual line measure, control and reporting system to improve lumber recovery. This has been a successful installation with significant improvements in lumber recovery and machine uptime.

When the system was purchased it was realized that a computerized reporting system would be useful to supervision for the control and analysis of production. The following reports are available individually or as part of the management shift report.

- Actual log tally. This is a piece count report by diameter class and length as well as log volumes by diameter and length class.
- Projected lumber tally. This is a piece count and projected footage by board size based on the number of logs in each sawing pattern.
- Projected log utilization and recovery by set. Lumber, sawdust and chip volumes, footage and LRF are projected for each sawing pattern.
- Multiple shift report summary. This report summarizes total logs, volume, footage and average log diameter daily, weekly and monthly.
- Month to date piece count summary by diameter class. Total logs by diameter and length are summarized month to date.
- Downtime report. Delays of two minutes or longer are recorded with the actual time they occured. These are summarized by time period and totalled.
- Manual mode report. This reports the time of day, and elapsed time during the shift when the operator ran the machine in the manual rather than the automatic mode.

The managment shift report is reviewed daily for the control and analysis of production.

The actual log tally and manual mode report are used together to analyze manual operation of each shift. The log tally includes a number indicating the manual sets while the manual mode report details actual time and duration in the manual mode. Although not a major problem now, operators occasionally switch to manual for a particular log and forget to switch back to the computer. Manual operation may also be related to operator changes or break periods. Not only is lumber recovery better while running on the computer but the machines perform better. Corrective action should be taken with operators for excessive manual operation. A record of manual sets and time in manual mode is important in ensuring your process control system is being utilized to its fullest.

The multiple shift report summary provides cubic volumes and average log diameter daily, weekly and monthly. Recorded cubic volumes are useful in verifying lumber recovery as well as log volume throughput. An accurate history of average log diameter will assist in planning mill equipment changes. Decreasing log diameters will affect decisions on how to improve or maintain productivity.

The month to date piece count summary by diameter class report is also an important history of mill throughput. Operator decisions on log destinations can be costly if automatic sorting ahead of log breakdown equipment is not part of your operation. An accumulated summary of log throughput by diameter will indicate how many logs

are incorrectly processed or too small for processing. Improved productivity through efficient log utilization can be greatly assisted by a record of log throughput by diameter class.

The downtime report can be the most important management information available from your microelectronic based system. Delays of two minutes and longer are recorded and summarized. The report will detail the times when the delays occurred and total length of the delay. The delays are summarized in various time interval groups and totalled. Although operating foremen can be quite good at recording delays there is nothing like a clock tied into your log breakdown equipment recording its idle time. Short delays due to mill flow problems or extended lunch and coffee breaks are very costly. A two minute delay every shift for a full year in a small log, high throughput mill could mean significant production losses. An accurate record of delay time is a necessity in management information. Maximizing uptime is a key to productivity and will be greatly assisted by a downtime report.

The computer memory is programmed with cutting patterns which can be changed by keying in new diameter breakpoints on the systems teleprinter. A minor change in these breakpoints may result in overchipping, therefore they must be set to suit the machines and log diet. Operators may complain about too much wane but changing breakpoints by one-tenth of an inch on small logs can result in significant lumber recovery improvements and must be considered a management function. Any changes in diameter breakpoints should be recorded in order to verify recovery after such changes.

Operator decisions, log volumes and diameters and machine idle time are all very important factors in sawmill productivity. A microelectronic based system provides the management information necessary to analyze these areas in both the short and long term. The software package in a microelectronic based system should provide access to information necessary to analyze mill operations in depth. The management information available from our system has provided me, as a mill superintendent, with daily reports much like an electrocardiogram.

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* * *

Question Period

Question

Bert Seaman, did I hear you correctly that you have taken out your log sorter, your header, your chipping saw machines, whatever you have?

Bert Seaman

Yes, we have eliminated that log sorter and we are doing an eyeball sort in the sawmill. We now have our three hot ponds that will feed any of our four lines or any of our four debarkers. We hope to invest in a cross hall log sorter over the next two or three years. It is going to cost us a lot of money but we figure that it will also save us a lot of money.

Question

So you are setting your machines manually now rather than having setworks on your machines?

Mr. Seaman

We have the automatic setworks on the two chipping saw lines with manual over-ride.

Question

Okay, I thought that maybe you were starting to lose recovery but you are not. You still have something in the system that will give you good recovery.

Mr. Seaman

Well, we have always had the electronic measuring devices, or whatever you call them, inside the sawmill as well as when we had the log sorter. They measure our logs for the machines but they also measure everything that goes into our mill and they give us a read-out at the end of the day of how many cubic feet went in, how many cords of wood, how much lumber we got per cord. We get the whole report right at the end of the day.

Question

I just wondered how long it takes to process an IRDP application so that the program can move ahead?

Mr. Renaud

That is a loaded question. How long does it take? Unless there are other problems, manpower and so on, six to eight weeks and the money will come after you have spent them. Submit the claims and we will float the money, but you will still need bridge financing for a period of, say, the implementation period plus three months. Now that is for capital projects. For an innovation element, it goes quicker because it is on strict progress claims. You can send those in every month and you will get a cheque within a couple of weeks, but they are smaller amounts of course.

Question

Now the emphasis is more on efficiency and modernization rather than job creation? Is this correct?

Mr. Renaud

Yes, that is correct. We do not want to create over capacity and, on the other hand, it is recognized that if we want to retain the jobs in a particular industry on a long term basis, we need productivity improvements.

Question

My name is Bob Ziner from Ziner Lumber. We have done some work with the Manpower Consultants Program. There definitely are programs available for just about any type of training that you can justify to the government as beneficial to productivity, quality control, or any type of general improvement within an industry. Manpower Consultants is a very valuable service in helping to co-ordinate the information and the availability of both funds and assistance through the government.

Mr. Renaud

I assume that Canada Manpower Consultants Services worked with your firm on an one-to-one basis, in house. Is that what happened?

Mr. Ziner

Well, the basis of the program is essentially that they will work with a company provided that there is a joint effort between the employees and the employer to create increased productivity and better skills.

Mr. Lacroix

I would like to add that there is a course in the area if you contact Northern College. There is a course going

on in basic and advanced electronics. The response is so good that they are actually giving three courses a week for the about 10 people. If there are 10 people interested in the area, Northern College will set up a couse in retraining so that it is available right here.

Question

In his presentation Peter Murray made reference to the use of sensors for preventive maintenance. I do not know whether Peter, or someone else in attendance here, could throw some light on that. I think it would be a tremendous leap forward if you could identify maintenance problems in advance.

Peter Murray

I really cannot make any qualitative comments on it because it was one of my Buck Rogers ideas. We have been having a fair amount of problems with inaccuracy in certain components in a sawmill conversion, the saw guides, misalignments here and there. I found that our maintenance people were not monitoring things as actively as they should have been. In trying to establish our size control program and get our target size down we kept running into problems. I just thought that if there was some way of sensing these misalignments and these excessive tolerances, it would give the maintenance people an opportunity to move in and do something about it. I am sure that if the capabilities are there it would give you the opportunity to have a much better maintenance program and reduce your downtime and lost time in production.

Larry Grove

On the systems for edgers and trimmers and even sorters, there are monitoring capabilities in place where we are not looking at the machinery itself, but at the sizes of the products. You can get quality control information from these systems as to what your actual lumber size, thickness, widths, etc. are, coming out of the mill. It is a very good indication that if you are not on target with your lumber sizes, you need to go look at your machinery and see where the problems might be.

Wayne Colin

Something I would like to add on that subject. If you have in your system some means of accessing that information it can quite easily be all laid out and printed out. We are in the process of putting certain sensors on our machinery so that we can detect excessive wear in the case of a chipping saw. We get trip outs on the motor just from putting a log through, big knots, etc. If you start getting a lot of this and you keep a record of it you can ask the question, is it bearings or is it saws and knives? If you have something such as a programmable controller, this information can be tied into it quite easily with a minimum amount of investment and at the end of the day or week you could have a print out saying that this happened so many times a day or so many times a shift and then act accordingly to find out if it is mechanical or electronical.

Question

I would like to ask Jacques S]guin how far away that futuristic mill is that will produce 500 board feet per man hour? Most mills today are running in the range of two to 300 which gives us a long way to go. Could you just comment on that? Are there mills today that are running at that rate?

Jacques Seguin

Some are close. I know a mill that is producing 480 board feet per man hour. That is Great West Timber. You could have asked Bert Seaman but he just left. He is over 400, way over 400.

Question

But you are not talking tree length?

Mr. Seguin

No, that is what I said, but it does not mean that if we are at 300 that we should set ourselves a target of 400. Let us set ourselves a target of 400 and work at it and increase the recovery at every machine centre, the headrig, edger and the trimmer and use automated equipment as much as possible. Doing that you would get very close to that with the type of logs you have.

Question

Jacques, we are talking about 500 feet per man hour. I have never been clear in my mind what man we are talking about. Is it with all the management group, the maintenance group, the group that slashes up the trees, the total manpower involved in the plant not the fellows operating the floor.

Mr. Seguin

No, everybody on the payroll. That is the only way. You do not have to include the President of the company, but starting from the superintendent, all the operators and the maintenance crew, chipping handling people, loader operator everybody on the payroll. Otherwise you cannot compare yourself to your next door neighbor. If he uses just the operators on the mill floor and you use everyone, you will not have comparable figures. You would be comparing an orange to an apple. If you bota take everyone then you can start to make comparisons between one company number 300 and another numbering 200, one will be better than the other. I still say that the target should be 500.

Question

I have a question for Jacques Seguin. In one of your sketches I was looking at the optimization system before the trimmer and that included some drop gates for the overhead lug chain. Is that thing in operation some place yet?

Mr. Seguin

We have requested the quotes for one of our clients for a system like that. We have had, I think, six or

seven people quoting on it. That is the way we have requested the quotes. We proposed to have an overhead lug chain with drop out gates underneath. They have all agreed and quoted along with our proposed concept. Now, if some of these people have already sold one, I do not know. Have you ever seen any of these?

Mr. Grove

There are trimmer optimizers in operation that do have drop outs ahead of the trimmer and for that matter behind the trimmer. These are used to make reman decisions on pieces on which it would be better for that piece to be edged down to a narrower piece rather than trimmed to a shorter piece.

Question

Mr. Gouldsborough, is there an option available in your programming that the tally will include the manual mode?

Mr. Gouldsborough

No.

Question

Is there a reason for that, or is it something that could be gotten around? There are times that we have found a very crooked log and you have to set it manually. That manual set is not entered appropriately into the tally at all, it just adds to the tally what the computer would have made it.

Mr. Gouldsborough

Ours is the same. I do not know whether that option was available when we bought the system or not, but I think the important thing for us is the number of manual sets that the operators do and the time in manual mode. In our system, a straight eight foot mill, the logs that are coming into the mill are really very good. We have our own slasher. We cut out all the crooks sweep ahead of the mill. There should be very few occasions when an operator makes the decision to over-ride and run in manual. We can watch that and if it is excessive we take corrective action with the operator. It is not really necessary in our mill, but it may be in other mills.

Question

But today we do not have any electronic means of detecting species?

Mr. Grove

Not that I know of.

Bob Stephens

Actually, I do not think it is going to be that difficult. We have already been involved in our Western Laboratory with exactly the same kind of problem. Slightly different species but the same kind of challenge. We are using chemical indication techniques which produce different colors, which then can be picked up by electronic sensing systems.

Question

Can you do this at high speeds?

Mr. Stephens

I really cannot comment on the high speed aspect of it. We are heading toward a plant trial as far as I know at the present time. I would be happy to get the information and let you know. There are chemical indicators known in wood technology for many years that will give you a different color reaction on spruce to pine.

Question

I just wanted to come back to this morning's session for a minute about training. There was some discussion about the availability of training and how it had not been used. Last September we tried to enroll one of our kiln people in a kiln drying seminar that Forintek had in Ottawa in September. The entry list was completed within three or four weeks before the program started. What is the Forintek schedule for training for the next while in those areas? Do you know?

Mr. Stephens

Kiln drying or all those areas?

Question

Anything in the respect we are talking about today. Is Forintek prepared to start a program, be it in the various communities or in Ottawa in connection with this?

Mr. Stephens

Well, Forintek is basically prepared to start training programs in any subject which industry considers to be relevant and important. I am not pretending that we are ready to spring into the microelectronics engineering gap right at this very minute. We are, however, getting ourselves prepared to try to fulfill that sort of role. We have been talking to industry in the last few weeks in preparation for our 1984-85 program plan to find out what some of the specific needs in the training and education area may be. We have a very clearly defined role within our package of strategy which addresses the whole subject of education and training. Historically, we have developed very strong connections with universities and institutes of technology. We now want to start to broaden this in a technology transfer concept and start getting closer to industry in real training terms. I hear your comment about the kiln drying program. I think that we will not be having that kind of problem in the future because our plan, although not yet implemented, is to take the course to the people,

rather than bringing you to Ottawa and have to face the problems of only taking so many people at one stage in the year. We are very, very conscious of that challenge. I do not have very much progress to report to you at the present time apart from a lot of good intentions. Those are not idle words. I will be getting back to you through the associations on that particular topic.

Question

I want to direct this question to Mr. Grove. You dealt with program variables, the two I am interested in are the individual board price and chip price. What about the price variation based on length, width and grade consideration? In the average mill I would say we are looking at six different lengths and approximately 10 to 12 sizes and the grade aspect as well. I presume that you feed this price factor into your computer, then these decisions are made by your edger and your optimizer, is this correct?

Mr. Grove

Right, that price matrix that I had on the screen unfortunately is very hard to read. It did show an individual price for each product you make with respect to width, length, thickness and up to four grades in that particular matrix. I do not remember the 16 different thicknesses and eight widths. It is an all-encompassing program. We have not found a mill yet where the data base was not large enough to handle.

Question

Just as a matter of curiosity, what is the price for your edger optimizer? Just a ball park figure.

Mr. Grove

The computer control scanning part of it is in the $300,000 to $400,000 range. The mechanics can vary all over the place depending on what is needed for your particular mill to get the system installed and in operation. That is a pretty good ball park range.

Question

What I am wondering about is what kind of training would an electrician need to maintain all the pieces of equipment mentioned? What kind of people should we have on the ground? We have some people here from Hurst or Dubrueville which are far away. If something breaks down, do you expect the company to have two systems or spare parts for the whole system or should there be some special training involved.

Ed Rickford

Well, of course you should always have training. Companies such as ours have formal training programs set up which we send out to industry. We would like to do the training in groups in order to realize some economics of scale. My observations were that industry does not respond well to those types of things, but you need to have training. In addition to that we have designed our system so that you have what I call an active spares computer. Instead of having spares in cardboard boxes on the shelves where people throw coffee or take it and destroy it, you have to have spares no matter what you do. What I am saying is that I think the spares are better served in an active mode where they are there but they are not integral to the system itself, you see.

Question

Okay, but what do you expect the company to have an electrician, engineer, technician what?

Mr. Rickford

Generally, I find a technician is hired by most companies. They are the ones that develop this keen interest in the system, they are of the electricial superintendent level, I would say, intellectually.

Question

Okay, so basically are you saying that if a company would put up an automatic system, they would have to have some type of technician there. Would it be a big drawback if they did not have it?

Mr. Grove

I would comment on that. Systems technology in microelectronics is becoming more integrated. In the past you might have had five or six large printed circuit boards. Now they are all put onto one small little chip. The actual systems themselves have become, from an operator's standpoint, much simpler to understand because you really do not have to get down into those four or five boards that are now on one little chip. You basically have to know whether it is in a fail mode or a working mode. Troubleshooting and maintaining the system is becoming much easier as the electronics themselves are progressing, and the programmable controller is a good example of that as well. I guess it is kind of a funny way to say it, but as electronics are becoming more and more sophisticated they are also becoming easier to maintain.

Mr. Rickford

That is a good point. All the system should do is diagnose where the problem is in the card. The card is returned to the company in an envelope and the back-up, whether it is in an active mode or passive mode, is installed and you should be able to continue running forever and ever. It does not always work out that way but that is the basic principle.

Mr. Gouldsborough

Maybe I can add to that. They system that we installed at Spruce Falls has been very successful. Uptime has been very good. We have had few problems with the system and once you get to learn it.

it is fairly easy to learn how to diagnose problems. It has self-diagnostic features so that you can troubleshoot the system. They are not something to be afraid of and we are very happy with the system. We were offered training sessions by the supplier. Part of our management group has taken them and we have had our electrical people take them. We have no problems with the system.

Tony French

I would just like to back up Bob Stephen's comments a moment ago, about training from Forintek. My reason for adding to it is that I have had three or four people ask me today about this point. We are very much committed to technology transfer from Forinek, particularly over the next year. Bob is perhaps hesitating a little bit at the moment because he is smack in the middle of a rather serious budget problem with regard to kiln drying. We have had the traditional kiln drying course. We plan to move these courses out into the regions. We have a correspondence course which I do not think is being used that much in the east for kiln drying, and we are going to look at other programs as well. The timing has caught us a little flat-footed but a few days ago we finished our budget program in the west and we have put together a series of 48 regional training courses which is something quite new for Forintek. I am very sincerely hoping we can do a similar kind of program here with Bob and the Ottawa Laboratory. If you have any thoughts or suggestions, we would appreciating hearing them directly or even through your associations with the OLMA or through the CLA. This kind of input is the kind of thing we need at the moment.

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Closing Remarks

R.W. Stephens
Forintek Canada Corp., Ottawa

It seems to me that we have had such a wealth of information exchanged today that I would like to try and take a stab at summing it up in a couple of minutes. I would just like to skip over the highlights of today's discusson and refresh our memories on what we have talked about and listened to today.

We have reminded ourselves of the importance of our industry to the national economy and let us not forget that. The facts of the situation are that 70 per cent of the softwood product is exported and we are responsible for about 45 per cent of world trade. Those are figures that we should feel really proud of. It is amazing how many people out there do not know those facts.

We know that the forecast for the future is healthy and we have been told that the demand is projected to increase by 50 per cent over the next 20 years on a world wide basis.

We have defined the challenge, I think, that faces the industry. World markets are becoming more competitive, we have heard that from several speakers today. Canadian wood and production costs are high, we have also heard that one. We know how to solve it we just have to shoot for Jacques S]guin's targets. Conversion efficiency of Canadian sawmills has run through each of the presentations that I have listened to today, and I hope you got the same kind of message. That leads us to a basic conclusion that instead of calling it improved productivity, we should call it a better sense of cost competitiveness which we only achieve through improved productivity. This will be the way, as far as I am concerned, to Canada's future survival in the world wood products market.

Although the world demand is projected to increase by 50 per cent by the year 2000, we must not forget that there will be an abundance of world forest biomass, particularly from countries that Canada trades and competes with. Canada will no longer be the dominant force in a scarce resource. We will simply be a major participant in an increasingly competitive environment. That does not mean that we cannot be successful but I think we have to be aware of the facts. We have reminded ourselves that being cost competitive means addressing the productivity aspects of labor and capital inputs. We have heard new and exciting things about developing technology and new equipment, particularly this afternoon. We have to do something about our conversion efficiency, our labor costs and raw material costs. In other words, the total production cost package needs our best attention. We have to agree that there is some indications that Canadian production costs, vis-a-vis the rest of the world, will be high for some very good reasons that we perhaps do not have all the answers to at the present time.

Delivered wood costs will increase faster in real terms because we are still relying on an increasingly inaccessible and lower quality old growth resource. We are already admitting to the fact that we have timber deficit areas in Canada. We are starting to admit the fact that we have a problem.

We were reminded by our very first speaker today, Mel Giles, that our labor record is now abysmal we top the list. We are also reminded that the level of technology in Canada is lower because our competitors are spending more on R & D. Just a few minutes ago we were discussing the need for more training programs in many areas to deal with the fantastic amount of change that is taking place in a very short space of time. I am certainly encouraged by the tremendous sense of urgency and awareness that I get from this group today, you obviously want to do something about it.

We are converting something that grows but it does not grow fast enough in Canada. One of the most important factors we must be conscious of is that our competitors are investing considerable efforts into intensive forest management, while we are still talking about the possibility of running out of natural timber. Canada must put more emphasis on productivity gains to carry us through the transition period from relying on natural timber to relying on second growth stands. We must find ways to compensate for higher relative production costs in the interim period. This means a concerted effort by government, industry and labor to work together.

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Forintek Canada Corp.

Canada's National Wood Products Research Institute

Established in 1979 as a private, non-profit corporation. Forintek is funded from contract research work, industry support, and government grants and contributions. The staff of 200 is about equally divided between its Western Laboratory in Vancouver and its Eastern Laboratory in Ottawa. The corporate office is located at Vancouver, at the Western Laboratory.

A key element in the operation of Forintek is industry involvement in its research programs. This is accomplished through Research Program Committees and a Board of Directors which consist largely of senior representatives from industry, as well as representatives from federal and provincial governments. It is through these forums that a means is established for industry to have strong input into Forintek's operation, program planning and assessment.

By responding to industry's research needs directly, Forintek plays a vital role in solving technical problems and helping the Canadian wood products industry maintain its competitive position in world markets.

"Productivity improvement" is a common objective for industry and government alike. Accordingly, the federal Department of Industry, Trade and Commerce and Regional Economic Expansion is financing a series of seminars addressing productivity improvement through electronic-based technology. Forintek Canada Corp. will be presenting these seminars on behalf of the federal government during 1983 and 1984.

Enquiries relating to Forintek's services and seminars may be directed to:

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